P-47 THUNDERBOLT VS GERMAN FLAK DEFENSES

Western Europe 1943–45

JONATHAN BERNSTEIN

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INTRODUCTION

By the end of 1943, it was clear that the next phase of operations against Nazi Germany would be an Allied invasion of the European continent. The strategic bombing campaign being waged by the US Army Air Force (USAAF) had suffered setbacks in the fall, but with the introduction of the P-51B Mustang as a long-range escort, heavy bombers of the Eighth Air Force were venturing even farther into Germany. The Ninth Air Force's medium bomber force operated similarly to that of the Eighth, using tight formations of B-26 Marauders and A-20 Havocs to attack infrastructure and strategic targets that were closer to what would be the frontlines in Occupied Europe following the Normandy landings on June 6, 1944.

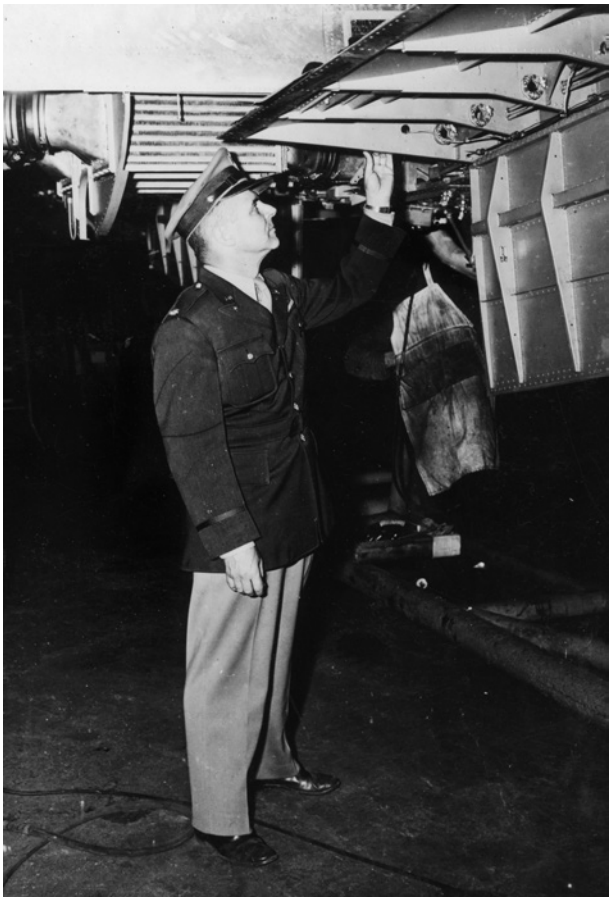
Yet despite an ever-increasing number of medium and heavy bombers in-theater, it was clear that a fighter-bomber would be necessary when it came to providing close air support for troops on the ground in the wake of D-Day – a smaller, more nimble aircraft that could carry a respectable bombload and then fight its way back home if necessary. The robust P-47D Thunderbolt, with its ability to absorb damage, stability as a gun platform and high speed in a dive, began operational testing in the fighter-bomber role as 1943 came to a close.

German forces in western Europe were also painfully aware of the impending invasion, as RAF and USAAF aircraft had been increasingly attacking tactical targets in France and the Low Countries. Upon being made General Inspector of the Western Defenses in early November 1943, Generalfeldmarschall Erwin Rommel immediately began reinforcing his Westwall defenses by adding an entire *Flakkorps* (consisting of between two and four *Flak Divisonen*, which could be either static or motorized) to defend against the coming aerial onslaught. Divisional structures were rearranged and reinforced to increase the number of anti-aircraft guns available to divisional commanders, and each *Panzerabteilung* (tank battalion) was given its own flak section

for immediate anti-aircraft protection. The stage was set for a direct confrontation between American fighter-bombers and German flak.

January 1944 was when everything changed. Prior to that, Eighth Air Force fighter groups assigned to VIII Fighter Command had been tied to escorting bombers at high altitude to the limits of their range, before turning for home in England. The USAAF command restructuring at the end of 1943 brought in Lt Gen James "Jimmy" Doolittle as the commander of the Eighth Air Force and Maj Gen William Kepner as the head of VIII Fighter Command. On Doolittle's order, VIII Fighter Command shifted focus, grasping firmly to the tenet that the "first duty of the Eighth Air Force fighters is to destroy German fighters."

Releasing VIII Fighter Command's units to hunt the Luftwaffe in the air and on the ground brought with it an unintended, but somewhat expected, consequence – losses to light and medium flak. Where P-47s had previously operated between 18,000–35,000ft, once released from their assigned escort leg, they were now permitted to get down on the deck in order to attack German airfields, and any other targets of opportunity, while egressing the continent. Despite the Thunderbolt's ability to absorb a significant amount of battle damage, both static and mobile flak proved it was not invulnerable.



Then-Lt Col James "Jimmy" Doolittle was photographed in 1941 during a visit to Republic's Farmingdale plant. The future commander of the Eighth Air Force is seen here examining the flaps of a P-43 Lancer under construction. His order for VIII Fighter Command to "destroy German fighters" rather than slavishly escort heavy bombers saw the P-47 become the USAAF's primary fighter-bomber in the ETO from January 1944 through to war's end. (Author's Collection)

In the early months of 1944, the Ninth Air Force had also completed its move from North Africa to Britain, where it was reorganised into the tactical counterpart to the Eighth Air Force in Europe. The change in command structure also prompted a shift in fighter assignments within both strategic and tactical air forces. Initially, Merlin-engined P-51Bs were to have been assigned to the tactical Ninth Air Force, while the P-47 was to remain with the strategic Eighth. Doolittle's assumption of command changed that, moving the longer-range Mustang into the strategic escort role and reassigning the robust juggernaut that was the P-47 into the tactical arena. The units given the fighter-bomber tasking followed in the footsteps of the Mediterranean Theater's 57th Fighter Group (FG), which had commenced such operations with the Thunderbolt from late 1943.

The Mediterranean Theater's Twelfth (tactical) and Fifteenth (strategic) Air Forces were equipped with limited numbers of P-47s by late 1943, and duly followed the Eighth Air Force in going after the Luftwaffe both in the air and on the ground. By early 1944, the Fifteenth's fighter groups had started to transition to the Mustang, with the 325th and 332nd FGs having transferred all of their Thunderbolts to the Twelfth Air Force by the end of the spring. The availability of these aircraft accelerated the Twelfth's transition from obsolescent P-39 Airacobras and P-40 Warhawks to the P-47.

The Sd.Kfz. 7/1 flak halbkette (flak halftrack) was one of several types of flak vehicle that formed the backbone of mobile air defense for the Wehrmacht. It mounted a single Flakvierling 38 antiaircraft gun and had a crew of eight. This particular example was assigned to an SS Panzer division. (EN Archive)

In the meantime, German forces had had four years to bolster defenses in France against the inevitable Allied invasion. The *Flakwaffe* (created in January 1942 as part of the Wehrmacht's *Flakartillerie*) was primarily focused on protecting the Reich from Allied strategic bombers, and, as a result, development of newer short-range light flak systems lagged behind the more advanced larger guns. The 3.7cm FlaK 36 was a very capable weapon, with good rates of fire, range and reliability. The single-barrel 2cm FlaK 38 and larger four-barrel Flakvierling 38 were adequate, but hampered by the limitations of a 20-round box magazine mounted on an autocannon that potentially had a cyclic rate of fire of 800 rounds per minute. Still, the FlaK 38 in either form was the most ubiquitous of the German anti-aircraft guns, and it remained in use for the duration of the war.

The light and medium flak units that would potentially engage Allied fighter-bombers hailed from four separate arms of the German military. The Luftwaffe provided the anti-aircraft defenses over geographic areas and airfields. *Marineflak* (Navy Anti-aircraft) defended the coastlines, while the *Heeresflak* (Army Anti-aircraft) and SS-Flak provided point anti-aircraft defense for Wehrmacht and SS ground units, respectively. These mobile and semi-mobile organizations would be Germany's critical counterpunch against the *Jabo* (*Jagdbomber* or fighter-bomber) threat.

Ninth Air Force *Jabos* commenced flying combat missions over the continent in early 1944. Like the fighter groups in the Eighth Air Force, Thunderbolt units began with bomber escort and fighter sweeps to gain familiarity with France and the Low Countries, learn where the heavily defended enemy airfields were and get a general lay of the land. The early months of Ninth Air Force P-47 operations over the continent saw all such sorties originate from airfields in England, and bombing missions were limited to striking transportation infrastructure in order to restrict German ground

movement in the lead up to D-Day. Such operations also allowed Thunderbolt flights to attack any German ground forces encountered.

By this stage of the war, command and control was still fairly limited over the continent, and fighter sweeps gave flight, squadron and group commanders the tactical flexibility to react to enemy contact as required. As the war progressed, new systems like SCR-584 radar enhanced that tactical flexibility by improving the Thunderbolt formation's ability to fly and fight in bad weather.

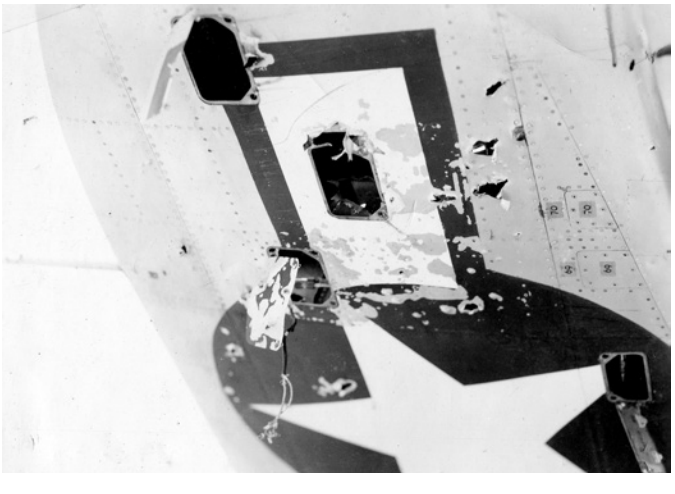
By early Spring 1944, the opposing forces began sizing each other up and probing for weaknesses. The first Ninth Air Force Thunderbolt loss to flak came on March 6, 1944 when Maj Frederick Nelander of the 362nd FG's 377th Fighter Squadron (FS) led a strafing attack on Twente aerodrome in the Netherlands after being released from escort duty on a "Ramrod" (short-range bomber escort) mission. Nelander, with 2Lt Russell Adams and 1Lts James Rippin and Joseph Lane following, dove down on the airfield, strafing tents, gun emplacements and whatever other targets were visible. Lane, flying as No. 4, had the clearest view:

> As we went down on the drome and I shot at gun emplacements, I saw Maj Nelander's ship was hit by automatic weapons fire as we crossed the aerodrome. Smoke came out of his engine immediately. The Major realized his plane was hit and called for someone to get on his wing because oil on the canopy obscured his vision. I had just gotten on his wing when he called 'Never mind, I can't keep the damn thing going, I'm going to have to jump'. As I went past, I made a turn over him and looked back and saw the plane explode, and immediately to the side of where the ship had been, [I] observed an open parachute going down.

Maj Nelander spent the remainder of the war at Stalag Luft I.

2Lt Adams, flying on Nelander's wing, made the comment that "[We] spread out to come down the runway. I machine gunned a row of tents. Automatic weapons fire came up at us. Maj Nelander wasn't taking evasive action from what I could tell as he came straight down the runway." Not taking evasive action and giving the angered flak gunners a straight line reference to a known point enabled them to quickly shoot him down – a mistake the other pilots in his flight would take to heart for the remainder of their combat tours.

Flak was always the most significant threat to the Thunderbolt pilot. As a result, new techniques were created to maximize the P-47's strengths against ground-based flak. New weapons like fragmentation and incendiary bombs and rockets were developed specifically to give the Thunderbolt an edge over anti-aircraft guns. However, the massive weight of fire of its battery of eight 0.50-cal machine guns was still the most effective and accurate way to engage and destroy German flak guns.



P-47D-22 42-25773 of the 379th FS/362nd FG returned to its airfield at Headcorn, in Kent, on May 30, 1944 with a shot-up port outer wing section, the fighter-bomber having been hit by FlaK 38 2cm rounds whilst attacking a target in France during the week before D-Day. The Thunderbolt was soon repaired, and it remained in service until written off in an accident at Sandweiler (A-97) advanced landing ground in Luxembourg on April 1, 1945. (NARA)

CHRONOLOGY

1930

February *Reichswehr* establishes the *Flakartillerie* to maintain an air defense umbrella over German ground units.

Spring FlaK 30 2cm anti-aircraft gun is designed by German engineers working for the Swiss firm Solothurn. It would enter service with the Kriegsmarine in April 1934.

1931

February 16 Seversky Aircraft Corporation is founded in Farmingdale, New York, by Russian immigrant Maj Alexander P. de Seversky. Former Bleriot engineer Alexander Kartveli is Chief Engineer.

1933

January 30 Adolf Hitler is voted in as the German chancellor, and he initiates a massive rearmament program to return Germany to world power status.

1934

Fall Sd.Kfz. 7 begins trials to meet a Wehrmacht requirement for a halftrack artillery prime mover.

1935

August 15 Kartveli's first military design for Seversky, the SEV-7 (also known as the Army XP-35), completes its maiden flight.

1936

Summer Rheinmetall and Borsig AG locomotive works merge, becoming Rheinmetall-Borsig, which would produce most of Nazi Germany's light and medium flak guns.

1938

Spring FlaK 38 2cm autocannon is adopted for low altitude air defense.

1939

September Seversky Aircraft Corporation becomes the Republic Aircraft Company.

Fall Rheinmetall-Borsig design a new mount that couples four 2cm guns around a central fire control system. Designated Flakvierling 38, it goes into production the following year.

1940

Spring Production of Sd.Kfz. 7/1 anti-aircraft halftrack begins, coupling Sd.Kfz. 7 and Flakvierling 38.

The FlaK 30 was Germany's first light antiaircraft gun. Designed to counter the slower, less capable aircraft of the early 1930s, the 2cm weapon was sorely obsolete by 1944. Nevertheless, it continued to soldier on until the defeat of the Third Reich. Here, a member of the gun crew is using an EM.R.36 1-meter focal length type rangefinder to confirm the altitude of an approaching aircraft. (EN Archive)

Summer Wind tunnel testing of XP-47 lightweight fighter commences.

1941

May 6 First flight of XP-47B nearly ends in disaster when oil leaking from the engine collects in the exhaust and fills the cockpit with smoke. Test pilot Lowery Brabham is able to continue the initial test flight, however, and later states he thinks the firm has "hit the jackpot." Republic is awarded contract W535-AC-15850 for 170 production P-47Bs and 57 P-47Cs the very same day.

1942

Spring Production begins on the Sd.Kfz. 7/2 flak halftrack, armed with a FlaK 36 3.7cm gun. Production of the Sd.Kfz. 10/4 shifts to the Sd.Kfz. 10/5, exchanging the FlaK 30 for the FlaK 38.

September XII Air Support Command is activated as the fighter-bomber component of the Twelfth Air Force and moves to North Africa.

1943

March 10 First P-47C combat mission flown by the 4th FG out of Debden, Essex, with pilots claiming three Fw 190s destroyed for the loss of two Thunderbolts.

The XP-47B closely resembled the production-standard Thunderbolt that would soon follow. Test pilot Lowery Brabham was very impressed with the aircraft, despite some technical problems during the course of its first flight. (Philip Jarrett Collection)

July P-47D-5-RE 42-8702 is modified with a new windscreen and blown Perspex canopy borrowed from a British Hawker Typhoon, creating the XP-47K.

Fall Deliveries of P-47D-15-RE/RAs begin. The new airframe now includes two underwing pylons to carry either additional ordnance or external fuel tanks.

October 16 Ninth Air Force re-established in England as the tactical counterpart to the strategic Eighth Air Force.

November 25 Eighth Air Force flies the first "Thunderbomber" mission to strike the airfield at Saint-Omer, France. Flak was intense and accurate, downing one P-47 and damaging six more.

1944

January Eighth Air Force commander Lt Gen Jimmy Doolittle shifts priority and declares that the first responsibility of VIII Fighter Command is to destroy the Luftwaffe.

February Ninth Air Force begins flying combat missions over Europe. Brig Gen Carl A. Spaatz, commander of US Strategic Air Forces in Europe, transfers a large number of Eighth Air Force P-47s to the Ninth Air Force for fighter-bomber operations as the new P-51B/C becomes available for long-range bomber escort.

February 22 Luftwaffe's III. *Flakkorps* is formed in Paris to provide anti-aircraft defense for the Western Front. On May 21 Generalleutnant Wolfgang Pickert assumes command, leading it until March 1945.

Spring Wehrmacht high command reorganizes the standard infantry division and adds a 12-gun *Flakbatterie* as part of each division's *Panzerjäger* battalion.

April IX Fighter Command is re-designated IX Tactical Air Command (TAC) under

Brig Gen Elwood "Pete" Quesada. IX TAC is the first of three Tactical Air Commands assigned to the Ninth Air Force. Concurrently, XII Air Support Command is re-designated XII TAC, with its primary function being to provide fighter-bomber support to the Mediterranean theater.

May 27 Operational use of Napalm bombs begins when the 368th FG conducts the first combat drop on the afternoon of the 27th.

June 6 Allied invasion of Western Europe, codenamed Operation *Overlord*, begins. Thunderbolts fly nearly 2,100 sorties in support of the amphibious landings on the 6th, and nearly 2,600 sorties the following day.

Summer In addition to infantry division flak battalions, *Heer* and SS *Panzerjäger* battalions begin to receive three Self-Propelled Antiaircraft Guns for each battalion headquarters.

Summer Eighth and Twelfth Air Force Thunderbolts test the M8 4.5-in. air-to-ground rocket, with varied success.

July First P-47D-25-REs with bubble canopies reach the ETO.

August 12–21 Four Allied field armies (US 1st and 3rd, Canadian 1st and British Second) rapidly encircle the German 5th Panzer and 7th Armies in the Falaise Pocket after they retreat from Normandy.

August 15 Launch of Operation *Dragoon* (invasion of Southern France). XII TAC splits from the Twelfth Air Force, taking with it three of the six P-47 groups covering Allied forces on the Italian mainland to support the invasion.

November First Tactical Air Force (Provisional) is formed, assigning XII TAC directly to 1st TACAF. The new tactical air force supports both 7th Army and the French 2nd Army for the remainder of the war.

December 16 Wehrmacht launches the Ardennes Offensive. Thunderbolt operations in response are initially hindered by foul weather, but resume on the 23rd.

1945

January 17th Panzer Division receives 40 new FlaK 103/38 3cm guns mounted on unarmored Steyr 1500 trucks.

March 7 US 9th Armored Division captures the Ludendorff Bridge over the Rhine at Remagen. The Henschel Hs 297 "Föhn" 7.3cm barrage flak rocket launcher is tested against Thunderbolts, without effect.

May 8 VE Day and the cessation of hostilities in Europe. Germany surrenders unconditionally.

September 27 The 6,670th and final Evansville-produced P-47N is the last of 15,686 Thunderbolts built from 1941 to 1945.

As commander of IX TAC, Maj Gen Elwood "Pete" Quesada flew as much as he could. He was rated in the P-38, P-47 and P-51, and is seen here climbing into an F-6C Mustang of the 109th Tactical Reconnaissance Squadron. (USAAF)

DESIGN AND DEVELOPMENT

REPUBLIC P-47 THUNDERBOLT

The XP-47 was initially intended as a high-altitude, lightweight interceptor, designed around the 1,150hp Allison V-1710-39 liquid-cooled V12 in-line engine fitted with a two-stage supercharger for improved performance at higher ceilings. During wind tunnel testing in 1940, several configurations of contoured fuselage cooling intakes were trialed, including an annular radiator behind the propeller spinner, an under-fuselage P-51 style scoop and wing root intakes like the P-39.

However, after combat data from the Battle of Britain began reaching the US Army Air Corps (USAAC), changes to several contracts were implemented to improve fighter aircraft then in the design phase. One such change was the redesign of Alexander Kartveli's streamlined XP-47 to allow the fitment of a new powerplant in the form of the turbo-supercharged 2,000hp Pratt & Whitney R-2800-21 18-cylinder two-row radial engine. Due to the latter's sizeable weight and dimensions, the fighter's elegant, smooth lines gave way to the aeronautical equivalent of a bare-knuckle brawler.

The comprehensive nature of the redesign necessitated a model designation change, resulting in the new fighter being identified as the XP-47B. The aircraft went from "paper to prototype" in a mere eight months, taking to the air for the first time on May 6, 1941. Prior to the prototype's maiden flight, the USAAC had shown interest in up to 733 airframes. The first contract was inked on the very day the XP-47B initially took to the air. Republic Chief Test Pilot Lowery Brabham led the flight test

NACA's high-speed wind tunnel at the Langley Aeronautical Laboratory in Hampton, Virginia, was used to test several cooling system configurations for the original XP-47 design. However, combat data received from the RAF immediately after the Battle of Britain quickly forced a complete redesign of the aircraft around a more powerful radial engine. (NASA)

program, and he quickly proved critical in identifying necessary design improvements.

The Thunderbolt prototype was larger than all previous fighters by a substantial margin. Indeed, it was more than twice the weight of most of its contemporaries, yet the powerful radial engine enabled it to reach a maximum speed of 412mph shortly after making its first flight. Production difficulties and numerous technical problems followed, hindering the development of the Thunderbolt. Indeed, the first of 171 P-47Bs was not delivered to the USAAF until March 1942. A further three months would pass until the 56th FG was issued with the first examples to reach a frontline unit.

From September 1942 production switched to the P-47C, some 602 examples eventually being built. This variant differed from the B-model in having a slightly lengthened (by 10.5in.) forward fuselage, a new engine mounting, changes to the rudder and elevator balance system to improve agility and the ability to carry a 200-gallon ventral drop tank.

In March 1943 the C-model entered combat as a high-altitude escort fighter – a role it performed very well over modest distances. But as the Eighth Air Force's bomber streams ventured deeper into Germany, the P-47s would inevitably have to turn back at the limits of their range, leaving the B-17 Flying Fortresses and B-24 Liberators unescorted during the most critical segments of the mission. By the fall of 1943, the Luftwaffe had developed techniques to attack escorting Thunderbolts as early as possible, forcing them to drop their external tanks and thereby prematurely stripping the bombers of their escort.

The solution to this problem was simple – an aircraft with more internal fuel and better range. The Allison-engined P-51A had entered production in late 1941, but by the third quarter of 1942, North American Aviation had grafted the British Rolls-Royce Merlin engine to the airframe and solved the early Mustang's performance problems at ceilings above 18,000ft. The Merlin-powered P-51B/C had the speed, altitude performance, internal fuel and range to become the ETO's new escort fighter of choice, and it was ready for production by the summer of 1943.

But the Thunderbolt's design had been evolving as well. Combat reports and pilot suggestions were taken to heart and new airframe and powerplant modifications were continuously being added to the P-47 throughout 1943. The P-47D-1, of which 114 were built from December 1942, was the first Thunderbolt model produced at the company's new Evansville, Indiana, plant. It differed little from the previous C-model except for the standardization of water injection into the intake manifold to produce more prolonged combat power of 2,300hp at 27,000ft. Other changes included additional armor protection for the pilot, further improvements to the fuel and oxygen system and the exhaust ducting was again modified for better reliability and performance. The 114 P-47D-1-RAs from Evansville were near-identical to Farmingdale-built P-47C-2-REs. However, P-47D-1-REs differed from earlier

versions in having an additional pair of flaps on the engine cowl to vastly improve cooling of the R-2800-21 engine, which suffered from cylinder head overheating.

The first major series upgrades came with the P-47D-5-RE, which introduced water injection into the cylinders of the R-2800-21 engine, thus increasing the cylinder pressure and boosting horsepower for a burst of speed. "War Emergency Power" could be used for short intervals and was controlled by a thumb switch on top of the throttle grip. The D-5 also introduced a new turbosupercharger, replacing the earlier C-1 type with the C-21. The new supercharger had a strengthened impeller and improved internal components for better high-altitude performance.

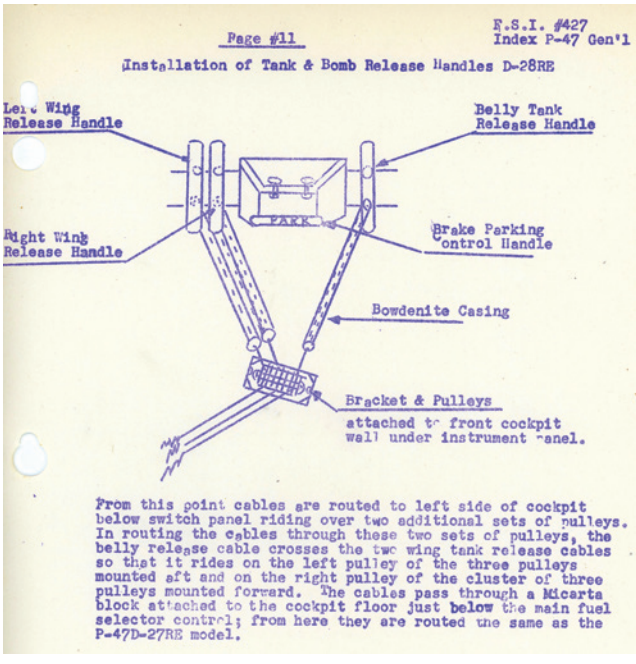
The fuel tanks were also redesigned, with revised baffles for better load balance. The main tank held 205 gallons, and 100 gallons were carried in the auxiliary. Pilot armor was improved by adding homogenous plating behind the seat that extended from the headrest to the cockpit floor and out to the fuselage sides. Lastly, and perhaps most importantly, the belly rack that had been intended solely for an external fuel tank was adapted to carry either a tank or a 500lb bomb.

As 1943 went on, it was clear that range was becoming an issue for the Thunderbolts in Europe. A single external tank increased the P-47's flight time, but it was not enough to allow uninterrupted escort of Eighth Air Force bombers into Germany. Thunderbolts being ferried across the Atlantic to Great Britain via Newfoundland, Greenland and Iceland had been fitted with makeshift underwing pylons carrying 165-gallon Lockheed external tanks, so it was clear that a pair of permanently mounted underwing pylons could be at least a partial solution to the range issue. By late 1943, the P-47D-15-RE began coming off the production lines at Farmingdale, followed closely by the near-identical D-15-RA from Evansville. The -15 was the first production model to feature underwing pylons that could carry either external tanks or bombs. The addition of pylons did have some minor effect on performance due to the increased drag, but the benefit far outweighed the cost. Internal fuel capacity was increased to 375gal and bomb load to 2,500lb.

With the P-47D-15's introduction to combat, the USAAF had a fighter-bomber that could carry a heavier load both farther and faster than the P-40F/L Warhawk, which was then the key fighter-bomber type flying ground support and interdiction missions in the Mediterranean. By early 1944, the 57th FG in Italy had completely converted to the D-model Thunderbolt, and pylon modification kits allowed the upgrading of its D-10/11s at unit level to bring them up to D-15 standard.

Since the Thunderbolt had not been designed as a fighter-bomber, there were some ergonomic issues in the cockpit that needed to be overcome in order to allow a pilot to perform this role more effectively. As previously noted, P-47D-15 series aircraft were able to carry bombs, and the release handles for these weapons were located on a console on the floor to the left of the pilot's seat. When it came time

Groundcrews from the 57th FG's 65th FS put the finishing touches on AN/M65 1,000lb GP bombs in order to commemorate the squadron's 3,000th sortie. The 57th was the first group to use the P-47D as a fighter-bomber. (Author's Collection)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Index P-47 Gen'l
Installation of Tank & Bomb Release Handles D-28RE
Left Wing Release Handle
Belly Tank Release Handle
Right Wing Release Handle
PARK
Brake Parking Control Handle
Bowdenite Casing
Bracket & Pulleys
attached to front cockpit wall under instrument panel.
From this point cables are routed to left side of cockpit below switch panel riding over two additional sets of pulleys. In routing the cables through these two sets of pulleys, the belly release cable crosses the two wing tank release cables so that it rides on the left pulley of the three pulleys mounted aft and on the right pulley of the cluster of three pulleys mounted forward. The cables pass through a Micarta block attached to the cockpit floor just below the main fuel selector control; from here they are routed the same as the P-47D-27RE model.

If battlefield innovation works, it becomes a standard. This is the Republic Field Service Order implementing the fleet-wide redesign of the P-47D's bomb release handles that Maj Gil Wymond and TSgt Billie Hahn of the 57th FG devised in Italy in late 1943. (Author's Collection)

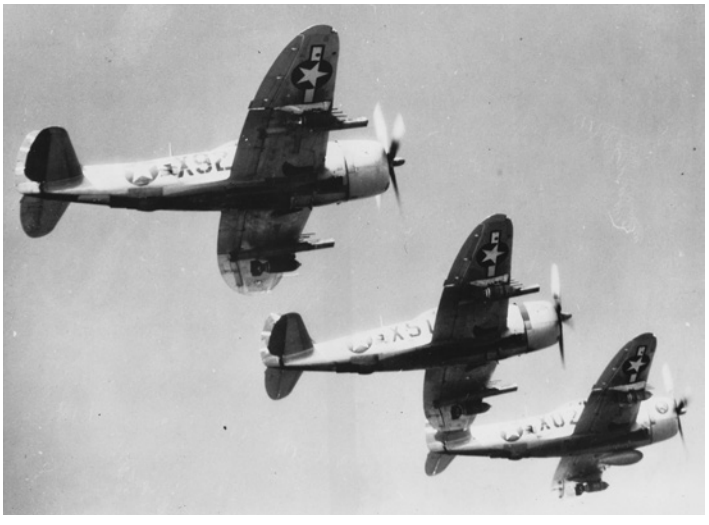
to expend the ordnance, the pilot would have to turn his body to the left before reaching down and pulling up the two wing stores jettison handles simultaneously, and then pull a third handle for the belly rack. When dropping external fuel tanks at altitude, this was not an issue. However, when diving on a target from 8,000ft and having to stay focused on both the target and the altimeter, moving in the seat and shifting vision to the floor of the cockpit while reaching down to grab the bomb release handles could significantly throw off a pilot's aim.

Since the 57th FG had been the first frontline unit to use the Thunderbolt as a fighter-bomber, it fell to the group's pilots to suggest improvements to the aircraft and its cockpit layout. Leading the way was 65th FS CO Maj Gil Wymond and chief armorer TSgt Billie Hahn, who, between them, devised a way to relocate the bomb release handles from the cockpit floor to the bottom center of the main instrument panel. The wing release pull handles were reinstalled on the left side of the parking brake handle and the belly release handle to its right. This meant that the pilot now only had to move his left hand from the throttle to the release handles, rather than having to turn his body before reaching down to the floor. With the pilot's attention now focused solely on the target, bombing accuracy improved significantly.

This modification, proven in combat by Wymond in his famous P-47D-15-RE 42-75712 *Hun Hunter II*, became standard throughout the 57th FG and was

eventually fully incorporated by Republic on the production line for the P-47D-28.

The most significant improvements for the "razorback" Thunderbolt began with the introduction of the P-47D-22-RE in the late spring of 1944, with this model being fitted with the 13ft Hamilton Standard 6507A-1 paddle-blade propeller and R-2800-59 engine/C-23 turbo combination. Thanks to the new propeller having significantly more lifting surface than the original Curtiss Electric 714-1C2-12 "toothpick" propeller, the D-22 benefitted from a significant improvement in both thrust and rate of climb.



"Bubbletop" Thunderbolts of the 79th FG climb away from their Fano airfield in Italy in the spring of 1945. They are, from left to right, a P-47D-28, D-27 and D-30, and two of the aircraft are armed with M8 4.5in. rocket tubes. All three are carrying a pair of AN/M64 500lb GP bombs, and the lead D-30 also has a centerline tank that may well be filled with napalm. (Author's Collection)

Just weeks after the first P-47D-22-RE arrived in the ETO, Thunderbolts boasting the next major improvement began to reach fighter groups in England. The blown Perspex canopy or "bubbletop" P-47Ds were the best performing variants to see action in World War II, and there were subtle differences between the sub-variants. The prototype "bubbletop" was pulled straight from the D-5-RE production block and modified with a cut-down aft fuselage and modified Hawker Typhoon "blown" canopy. The new type was designated XP-47K and was tested in the summer of 1943. Aside from some loss of lateral stability, the prototype performed very well. Visibility for the pilot was significantly improved in all directions, and when the aircraft went into production as the P-47D-25-RE the following spring, it also included modifications like a larger main fuel tank (increased from 205 to 270 gallons), either the R-2800-59 or -63 engine and Hamilton Standard or Curtiss Electric broad-chord propellers. All of these additions combined to give the "bubbletop" Thunderbolt an 800ft-per-minute increase in rate of climb over the P-47B.

The D-30 was the final version of the P-47D to see service in the ETO, and it included new dive brakes under the inner wing panels to assist in dive recovery at high speed when compressibility became an issue. The main control panel was also redesigned to be more intuitive for the pilot, and, for the first time, electric bomb releases were factory installed. This meant the pilot merely had to push the button on the control column to release his bombs.

The ultimate Thunderbolt to reach the ETO was the P-47M, flown exclusively in-theater by the 56th FG. Basically a P-47D-30 airframe mated with the new R-2800C-57 engine, the new model was by far the fastest Thunderbolt. Indeed, it boasted a rate of climb nearly comparable to that of the P-38. Topping out at nearly 480mph, the P-47Ms endured some early teething problems with their engines – specifically ignition harness failures and engine corrosion – when they arrived in-theater in late 1944 that resulted in several crashes. However, by February 1945, the technical maladies had been corrected and the fastest Thunderbolt was soon flying bomber escort and strike missions deep into Germany.

OPPOSITE

P-47D-21-RA 43-25528 from the 23rd FS/36th FG was lost to flak on March 19, 1945, with the pilot, Lt Warren F. Pierce, killed in action. This photograph, probably taken just a matter of weeks before the aircraft's demise, shows the Thunderbolt carrying a pair of AN/M65 1,000lb GP bombs and a 150-gallon "flat" auxiliary tank. (Author's Collection)

FLAK DEFENSES

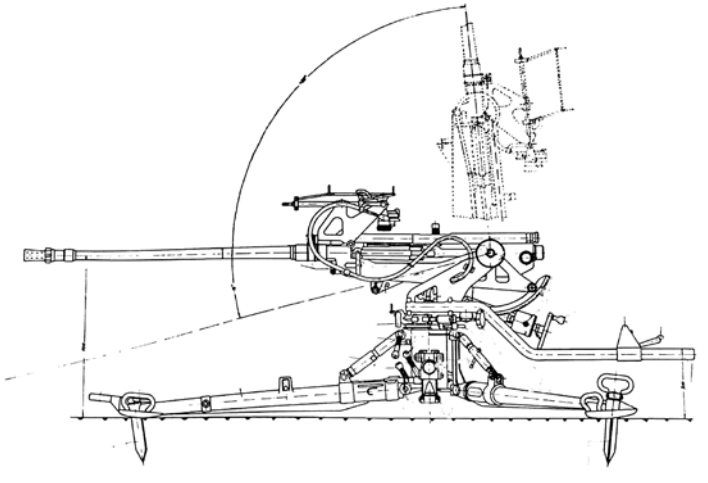
The development of German light and medium flak has its roots in World War I. While both sides developed and fielded 37mm automatic cannons for use in the antiaircraft role during the conflict, only the Germans created a 20mm weapon as well. The Becker 20mm cannon was adopted both as an aircraft and an antiaircraft weapon in 1916, seeing operational service in the latter part of the war. The Becker design, however, was just a first step.

After the German defeat in World War I, Becker's design team moved to neighboring Switzerland to work for Oerlikon. Here, they further developed the weapon into the Oerlikon 20mm gun that would be in use with most military forces around the world by the start of World War II, either mounted in an aircraft or in the antiaircraft role.

Another Swiss firm, Solothurn, also had an influx of German employees in 1919 when its parent company, Rheinmetall, was prevented from producing weapons due to the terms of the Versailles Treaty. The Solothurn S5-100 was the first in a series of box magazine-fed, recoil-operated, towed 2cm antiaircraft guns that began production in the late 1920s. When the Third Reich commenced its rearmament in the early 1930s, the S5-100 was upgraded with minor modifications and a new mount, and the Solothurn weapon went into production in a resurgent Germany at Rheinmetall in 1935 as the 2cm FlaK 30.

As a light flak gun at the beginning of World War II, the FlaK 30 was an adequate system. It had a relatively low rate of fire of roughly 120 rounds per minute, could reach airborne targets up to 3,500ft, and had a muzzle velocity of 2,625ft per second with armor-piercing ammunition and 2,950ft per second with high explosive. The weapon was fed from the left side of the receiver by a 20-round box magazine that ultimately became the gun's primary weakness. By limiting the feed method to a box magazine, the designers thereby restricted the gun's volume of fire to the speed at which the crew's loaders could do their job. Nevertheless, it was good enough for frontline service in the late 1930s as Germany rapidly rearmed in preparation for war.

The Swiss-produced Solothurn S5-100 was the preliminary design for the FlaK 30, and the two guns shared many similarities. (Author's Collection)



Rheinmetall-Borsig was also aware that the FlaK 30 lacked speed in traverse and elevation, and it corrected these issues in the next 2cm gun it produced – the FlaK 38. New gearboxes were designed that permitted a much faster traverse of the weapon in order to track the latest high-speed fighters at low altitude. Yet despite the traverse and elevation being significantly improved, the new FlaK 38 was still fed from the same 20-round box magazine as the FlaK 30. Indeed, the magazines were interchangeable between the Solothurn, FlaK 30 and FlaK 38. Despite this problem, the new gun's rate of fire increased to 220 rounds per minute, allowing the FlaK 38 to

The Wehrmacht was very quick to mechanize its flak forces once the war commenced, with this Sd.Kfz. 10/4 being photographed during the spring 1940 Blitzkrieg that resulted in the capture of France. (Author's Collection)

throw up significantly more lead for enemy aircraft to have to fly though. Despite early successes in the opening campaigns of the war, the gun was still limited by an inadequate ammunition feed system. Both the FlaK 30 and FlaK 38 would serve throughout the entire war.

As tactics evolved and warfare became even more mobile, both systems transitioned from towed to self-propelled, being mounted on the Sd.Kfz. 10 halftrack as the Sd.Kfz. 10/4 when equipped with the FlaK 30 and the 10/5 with the FlaK 38. The latter was also mated with fully tracked platforms, creating the Flakpanzer I (on the Panzer I chassis) or Flakpanzer 38t.

Transitioning from a towed antiaircraft gun to a self-propelled platform gave German flak gunners a significant edge when sighting and reacting to incoming enemy fighters. As a towed platform, the gun's prime mover would have to stop, the crew unhitch and emplace the weapon, and then load, aim and fire. Mounting the gun directly on the vehicle with its full crew enabled the latter to constantly be scanning the skies, and the vehicle to remain moving even while the gunners acquired and engaged incoming targets.

The Wehrmacht was keenly aware of the drawbacks of the single-barrel FlaK 38, and in 1941 a new mount was designed to incorporate four 2cm guns firing together. The Flakvierling 38 mounted two guns, inverted, on the right side and right side up on the left, with their magazines centrally placed between the quartet of weapons. The coupled rate of fire of four guns on a target greatly increased the lethality of German short-range antiaircraft fire. The gun mount also incorporated a new computing sight to better calculate a proper lead and firing solution.

The Flakvierling 38 was an impressive antiaircraft weapon, and Wehrmacht commanders put them to use extensively in this role. However, with shortages of ammunition and resupply constantly being interdicted by *Jabos*, at times they were hard pressed to provide critical air defense. (Author's Collection)

The guns were fired by a pair of foot triggers, one for the pair of guns on each side, and they were all controlled by a single gunner who was also responsible for elevation, traverse and aim. The other members of the gun crew were there simply to load the guns, which were still limited by their 20-round box magazines. A motivated loader could swap magazines roughly every six seconds.

Developed almost concurrently with the 2cm family of weapons were the larger, medium caliber, medium range FlaK 36 and FlaK 43 3.7cm autocannons. These two guns were effective at altitudes of up to 14,000ft (twice that of the 2cm weapon), forcing enemy fighter-bombers to fly even higher in order to avoid incoming flak. However, they were available in fewer numbers than the FlaK 38 and Flakvierling 38.

The Flakzwilling 43 further improved performance by adding a second gun on the same mount. Although large and unwieldy, in the static defense role, the Flakzwilling 43 was Germany's most capable and lethal medium-altitude antiaircraft gun. The key to its success was an unrivalled muzzle velocity, in addition to a higher rate of fire of more 300 rounds per minute. These attributes meant it could hit a target with high explosive 3.7cm rounds more rapidly, with higher kinetic energy and better target effect, than the FlaK 36.

The standard ammunition for both the FlaK 36 and FlaK 43 guns was the high explosive 3.7cm Sprenggranate Patronen 18. The projectile, which was five inches long, was filled with 0.856oz of PETN/wax explosive and capped by a 3.7cm Kopfzunder Zerl PV mechanical, self-destroying fuse. If the round was fired and did not make contact with the target, the fuse would burn through its base and ignite the explosive inside the projectile, producing a fragmentation explosion for an enemy aircraft to fly through.

Both weapons fed from a tray on the left side of the gun's receiver. Instead of a box magazine like the 2cm flak gun, the FlaK 36 and FlaK 43 were fed by a six-round stripper clip that ejected the spent shell casings downward and the spent clips out the right side of the receiver. This allowed the crew's loaders to continuously feed ammunition into the gun without having to change magazines.

The introduction of the FlaK 43 in 1944 doubled the maximum rate of fire for the 3.7cm gun from 80 to 160 rounds per minute. The 150 rounds per minute sustained rate of fire was better than the US 37mm or 40mm guns, at comparable ranges, and the impact of a 3.7cm

round on a fighter-size target was devastating. More often than not, a reported "88" impact on a fighter was a direct hit by a 37mm shell. While it was theoretically possible to shoot down a maneuvering, low-level, fighter-size target with an 8.8cm round, traversing and elevating an 88mm gun with enough lead against such a target at nearly 400mph was nearly impossible.

Both single-barrel 3.7cm gun types also became self-propelled from early 1943, mounting on both the Sd.Kfz. 7 and Sd.Kfz. 11 halftracks. Such a combination gave flak crews the ability to maneuver and conceal as required. The vast majority of German self-propelled antiaircraft guns were indeed halftrack-based. Although making these weapons mobile certainly improved their chances of survival, it was clear that a focused fighter-bomber pilot who pressed home his attack could demoralize the gun crew and force them from their weapon. It was also clear that a 6mm-thick steel splinter shield was not enough protection against armor-piercing 0.50-cal. bullets fired by American *Jabos*. Flak crews needed armored protection if they were to survive against the P-47. As a result, Germany attempted to develop a series of fully tracked and armored flakpanzers to defend the airspace above its panzer divisions.

Although only built in modest numbers (between 87 and 105 examples are believed to have been built), the Flakpanzer Wirbelwind gave the *Flakwaffe* a better-protected armored antiaircraft vehicle with which to engage attacking *Jabos*. This example was knocked out in southwestern Germany in early 1945. (USAAF)

With the introduction of the Panther and Tiger, the Panzer IV was intended to be phased out of frontline service, although it did in fact remain the most numerous type of tank in the Wehrmacht's Panzer divisions through to war's end. The Panzer IV hull was a versatile platform that could easily mount several different types of antiaircraft gun with minimal modification. The first attempt at a Flakpanzer IV was the Möbelwagen ("moving van"), which could mount either a single 3.7cm FlaK 43 or a 2cm Flakvierling 38 with a fold-down armored tub around the gun, along with the standard gun shield to protect the crew. The armored panels offered protection from small arms fire and shell splinters, but did little to improve the crew's survivability when attacked from above. The first Möbelwagen entered service in June 1944 and were immediately prioritized for the Western Front, being issued in groups of eight to the 9th, 11th and 116th Panzer Divisions' flak platoons. Just 240 Möbelwagens were built.

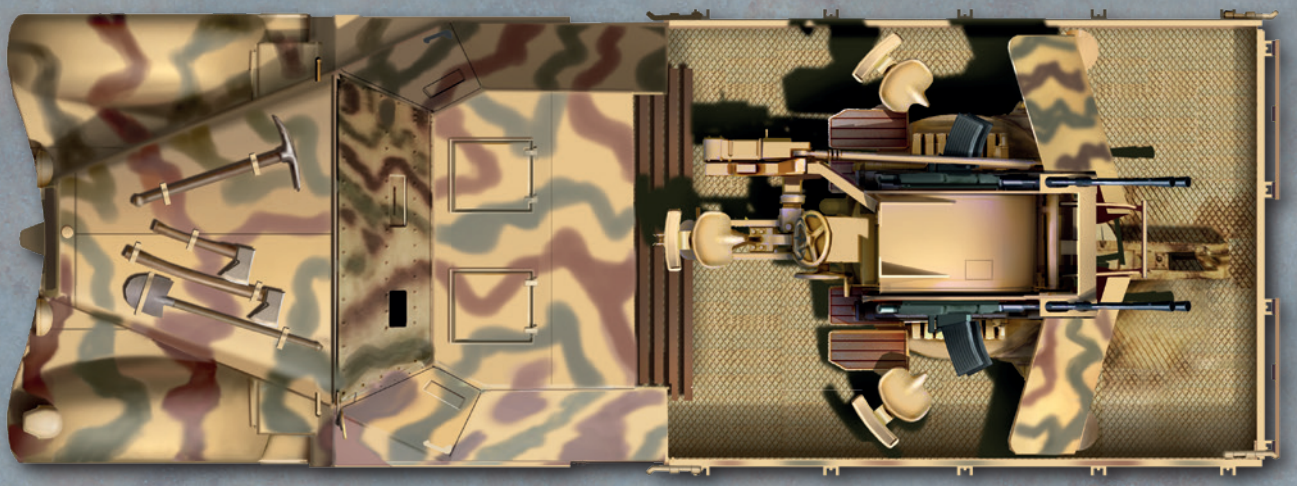
From July 1944, Deutsche Rohrenwerke's Ostbau Werke factory in Sagan, Silesia, began producing a new armored turret for the Panzer IV-mounted Flakvierling. The new "Wirbelwind" (whirlwind) offered much better protection for the crew, both from ground fire and fighter-bombers. It was still hampered by the limitations of its ammunition feed system for its quad 2cm FlaK 38, but inside the enclosed turret shell stowage was all within arm's reach for the two loaders. The Wirbelwind was arguably the most advanced and capable armored self-propelled flak system to see combat in World War II, and it was equally as effective in the ground support role. Between 87 and 105 Wirbelwind had been produced by war's end.

OPPOSITE

The Flakzwilling 43 was arguably the most potent low- to medium-altitude antiaircraft gun fielded by the Wehrmacht. Its blistering rate of fire (more than 300 rounds per minute), unmatched muzzle velocity and excellent computing sights made it deadly against any low-flying aircraft that strayed within in its vicinity. (EN Archive)

Sd.Kfz. 7/1

The Sd.Kfz. 7/1 was the first Wehrmacht vehicle to mount the Flakvierling 38 2cm flak gun. Originally fielded without armor, the halftrack with soon supplied with better protection for the crew and vehicle once frontline service in the battlefield exposed its frailty to attack by fighter-bombers.



Flakpanzer IV Wirbelwind

Although few in number, the quad 2cm FlaK 38-armed Flakpanzer IV Wirbelwind offered a significant improvement in crew protection and mobile firepower for Wehrmacht forces. Between 87 and 105 Wirbelwind had been produced by war's end, and they served primarily within Panzer divisions.

The Panzer IV-based "Ostwind" (East Wind) was also developed in 1944 as a replacement for the Wirbelwind. It featured an open-top hexagonal turret housing a 3.7cm FlaK 43 – smoke generated by this weapon when fired prevented the fitting of a sealed turret. The FlaK 43 was more effective at bringing down aircraft with a single hit thanks to the increased size of its rounds, although it had a slower rate of fire than the FlaK 38. The twin-FlaK 43-armed Ostwind II was devised to solve this problem, but only one prototype was completed prior to the defeat of Germany. Although the Ostbau Werke had received an order for 100 Ostwind in August 1944, the Wehrmacht had received just 44 examples by the time production ceased in March 1945.

As good as these flakpanzers were, it was clear that new guns were required because the FlaK 38 had reached it effective limit when engaging increasingly better armored Allied fighter-bombers. Two new guns did begin to reach frontline units by the end of 1944, both having been adapted from proven aircraft cannon and modified for the antiaircraft role. The 1.5cm FlaK MG 151/15 and later 2cm MG 151/20 Flakdrilling were triple mounts ("drilling" being German for triple) that saw three cannon installed either in a stationary mount or pedestal-mounted on Sd.Kfz. 11 or Sd.Kfz. 251 halftracks. As with aircraft-mounted MG 151s, the Flakdrilling's three guns were belt fed. This allowed them to maintain a far better sustained rate of fire than was the case for the smaller-caliber weapons. At 750 rounds per minute per gun, the weight of fire was nearly three times that of the 2cm Flakvierling 38.

Along with the MG 151/20, the MK 103 3cm aircraft cannon was also pressed into antiaircraft service. This proven, high-velocity 3cm weapon was intended to be the next major short-range flak gun for the Wehrmacht. By early 1945, 3,000 had been

ordered from two different firms, and unit deliveries began in late January 1945. The new gun was installed on a repurposed FlaK 38 mount that had been extensively modified to handle both the gun's weight and its massive recoil.

The standard FlaK 38 had a tool compartment at the rear of the mount platform, and during testing it was clear that the weapon's increased recoil had the potential to crack the hollow mount base near this compartment. The latter had to be reinforced with steel and filled with concrete, and large steel bands were welded to the outside of the mount base for additional strength. The basic weight of the FlaK 38 gun separate from the mount was about 75lb. The belt-fed MK 103 weighed nearly 400lb and fired a projectile twice the mass of the FlaK 38's 2cm shell at twice the rate of fire. Belted ammunition was fed to the gun via a large box on the left side of the gun, with expended shells ejected out the bottom of the weapon and through a space in the underside of the mount so that they did not interfere with traverse or elevation. Roughly 40 FlaK 103/38s had reached operational units by the end of the war, including a handful mounted on the 3cm Flakpanzer 38t – one was photographed in Prague's Wenceslas Square at war's end.

By the cessation of hostilities, prototypes were already underway for a four-gun Flakvierling 103/38 and an armored, self-propelled Flakpanzer IV "Kugelblitz" (Ball Lightning) that mounted two of the guns in a fully enclosed turret.

However, with the Wehrmacht stretched thin on two fronts by late 1944, efforts were focused on maintaining production of existing designs rather than developing deadlier flakpanzers. The ability to adapt and modernize came about far too late, when even new developments had little effect on the course of the war. And the Thunderbolt's ability to absorb punishment while zeroing in on its target made the Republic fighter the most potent low-level adversary the German flak arm would face.

The triple MG 151/20-equipped Flakdrilling mount on the Sd.Kfz. 11 halftrack was a potentially successful late war development that solved the ammunition feed issues associated with the FlaK 38. (Author's Collection)

TECHNICAL SPECIFICATIONS

P-47 THUNDERBOLT

The Thunderbolt was the first USAAF single-engined fighter to exceed 400mph in level flight. P-47Bs entering squadron service with the 56th FG in early 1942 were state of the art, and had exceptional high-altitude performance due to the aircraft's massive turbosupercharger. However, the B-model was not yet combat ready, with the 56th spending most of 1942 conducting operational testing that identified and fixed the problems afflicting the aircraft prior to the Thunderbolt being declared operational for service overseas.

While the P-47 was fast and packed a considerable punch with its battery of eight 0.50-cal. machine guns, the fighter was not without its weaknesses. The most obvious was its sloth-like rate of climb – the slowest of any Allied fighter to 20,000ft. It would take a Thunderbolt nearly 12 minutes to reach 30,000ft, a full three minutes longer than the Spitfire IX and a minute behind the P-51B. As the Thunderbolt climbed, it got faster through the thinner air. However, once leveled off at altitude, the P-47 was able to out accelerate and maintain a higher top speed than nearly all Allied and Axis fighters. Indeed, the XP-47B could maintain 412mph at 34,000ft, pulling 40 inches of manifold pressure at maximum throttle with the turbo on.

In late 1942, the P-47C-1-RE was introduced, incorporating an eight-inch fuselage extension at the firewall so as to improve cockpit cooling. It also included provision

P-47D-30-RE 44-20571 of the 386th FS/365th FG rolls past an unmanned mobile antiaircraft battery at the group's base at Metz (Y-34), in northeastern France, in late 1944. This aircraft survived the war, only to be lost in a fatal flying accident in western Germany on May 17, 1945. (NARA)

for a belly-mounted external fuel tank to increase flight time and, therefore, range – a critical factor when escorting bombers over Western Europe.

While poor rate of climb was a significant issue for the Thunderbolt, the fighter could out-dive anything in the sky once it arrived at altitude. Luftwaffe pilots learned very quickly not to try to dive away from an attacking Thunderbolt. Its unrivaled performance in a dive came in especially handy when P-47s at altitude would "bounce and zoom" enemy fighters. Pilots swooped down on their unsuspecting foes at high speed, firing quick bursts at carefully selected targets before using the momentum built up in the dive to zoom back up to altitude without losing much speed. The Thunderbolt's diving capability was just as effective when undertaking attack runs on ground targets, pilots using the fighter's speed and stability to present a minimal target to antiaircraft gunners and then zooming back up to altitude, and relative safety.

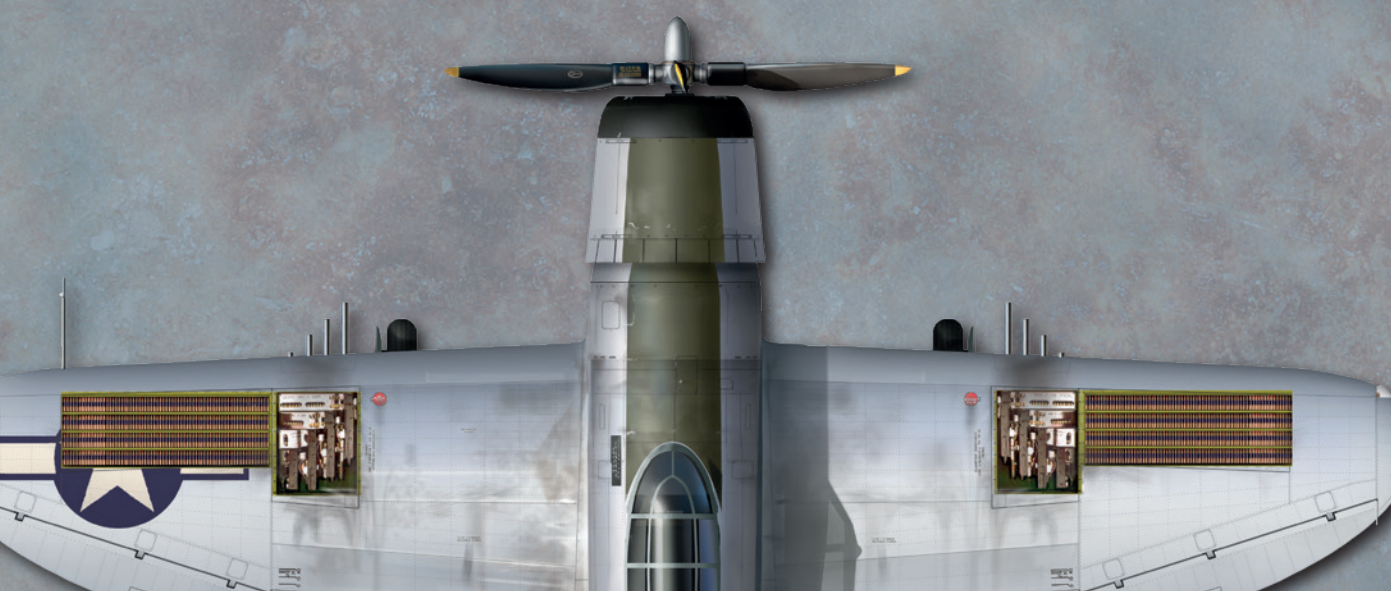
While the P-47C did see combat in Europe, the majority were quickly withdrawn from frontline service with arrival of D-series aircraft from mid-1943. "Razorback" P-47Ds were the first to be adapted to the fighter-bomber role, and from the summer of 1944 they were supplanted by P-47D-25-RE "bubbletops." The balance had quickly shifted in favor of the "bubbletop" throughout Ninth Air Force Thunderbolt groups by year-end. The P-47D Block 30 was the most produced, with 2,500 examples rolling off both the Evansville and Farmingdale production lines starting in the late fall of 1944.

Since World War II, there has been some debate regarding the relative effectiveness of machine guns and cannon when used by fighter-bombers in attacking ground targets. While each has its strengths and weaknesses, the Thunderbolt's battery of eight Browning AN/M2 0.50-cal. machine guns may have been the best balance between

P-47D-30-RE/RA Specification	
Powerplant	Pratt & Whitney R-2800-59 producing 2,800hp in War Emergency Power
Dimensions	
Span	40ft 9in
Length	36ft 1.75in
Height	14ft 2in
Wing area	300sq. ft
Weights	
Empty	10,000lb
Loaded	19,400lb
Performance	
Max speed	444mph at 23,200ft
Range	475 miles (without tanks)
Fuel	370 gallons of 100 octane in two internal tanks, 270 gallons in main tank and 100 gallons in external auxiliary tank
Rate of climb	2,200ft per minute
Service ceiling	36,000ft
Armament	eight Browning AN/M2 0.50-cal. machine guns, with 425 rounds per gun; 2,500lb of external stores (bombs, rockets and napalm)

AN/M2 0.50-cal. Machine Guns

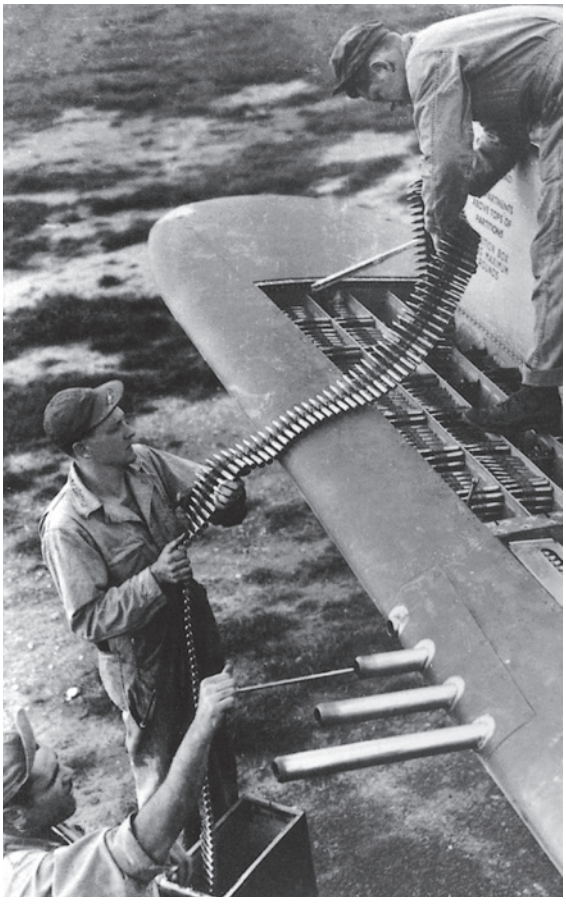
The Thunderbolt was equipped with eight wing-mounted 0.50-cal. AN/M2 Browning machine guns that could achieve a rate of fire of up to 850 rounds per minute. A five-second burst from all eight guns would put 500 rounds of M2 ball, M8 armor-piercing incendiary and M10 tracer into a 3ft x 3ft target area 1,100ft in front of the aircraft. Spent cases and steel links were ejected from the bottom of the wing through square, staggered, apertures.



the two types of guns. The cannon's advantage lay in its explosive projectile, which also benefited from muzzle velocity and superior mass. However, a larger projectile and shell meant a reduction in ammunition capacity. The 0.50-cal. round was smaller and lacked the cannon shell's explosive filler. However, where fighters like the British Hawker Typhoon carried four 20mm cannon, with 120 rounds per gun, the Thunderbolt carried twice as many 0.50-cal. machine guns and up to 3,400 rounds of ammunition.

The AN/M2 fired 600-800 rounds per minute at a muzzle velocity of roughly 2,900ft per second. Ammunition belts were normally a mix of M2 ball, M8 armor-piercing incendiary and M10 tracer. While not truly an explosive cannon round, the M8 would ignite a small amount of flammable filling due to the impact of striking a target, which would detonate and ignite any adjacent flammable materials.

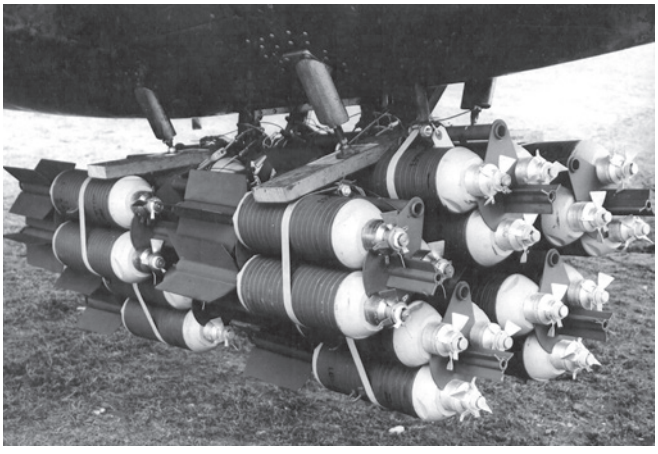
While the 0.50-cal. battery was the Thunderbolt's main armament, its underwing and belly stations could carry a significant quantity of ordnance. The mainstay was the AN/M64 500lb General Purpose (GP) bomb, which was filled with either 262lb of Amatol or 267lb of TNT. The bomb measured just under five feet in length, and it could be carried on any of the Thunderbolt's three hardpoints. Standard fusing for the M64 was the M103A1 nose fuse or the M101A2 tail fuse. When the fuse impellers completed a certain number of rotations due to the relative wind as it fell, the bomb would arm.



Armorers reload the wing magazine (which could contain 1,700 rounds) for the four AN/M2 0.50-cal machine guns mounted in the starboard wing. With each gun capable of expending 750 rounds per minute, such firepower made the P-47 an ideal strafing platform. (Author's Collection)

The Thunderbolt was also able to carry a large AN/M65 1,000lb bomb under each wing as well, although the weapon was too big to be affixed to the centerline station. Proportionally, the M65 was similar in size to the M64, with slightly more than half of its weight consisting of explosives and the remainder bomb casing. It was ten inches longer than the 500lb bomb and, at 18in in diameter, it was four inches wider than the AN/M64. Both bombs also used the M103A1 nose fuse, although the M65 was also fitted with the longer M102A2 tail fuse.

Trials were also undertaken to see whether the AN/M66 2,000lb GP bomb could be employed by the Thunderbolt, which had the power to carry two such weapons. The mounting lugs on the M66 were spaced wider apart than on the M64 and M65, however. As a workaround to the mounting lug issue, groundcrews fabricated straps that were slung around the aft section of the bomb body and hooked to the rear pylon locking lug. The front lug was mounted normally. Col Van H. Slayden, who went on to command the 36th FG from early 1945, took part in the testing of the aircraft with the one-ton bombs. During the take-off run for the first trial flight, he recalled "the airplane hit a bump, the straps broke and the two bombs snapped right off and continued down the runway." The 2,000lb bomb experiment ended soon thereafter.



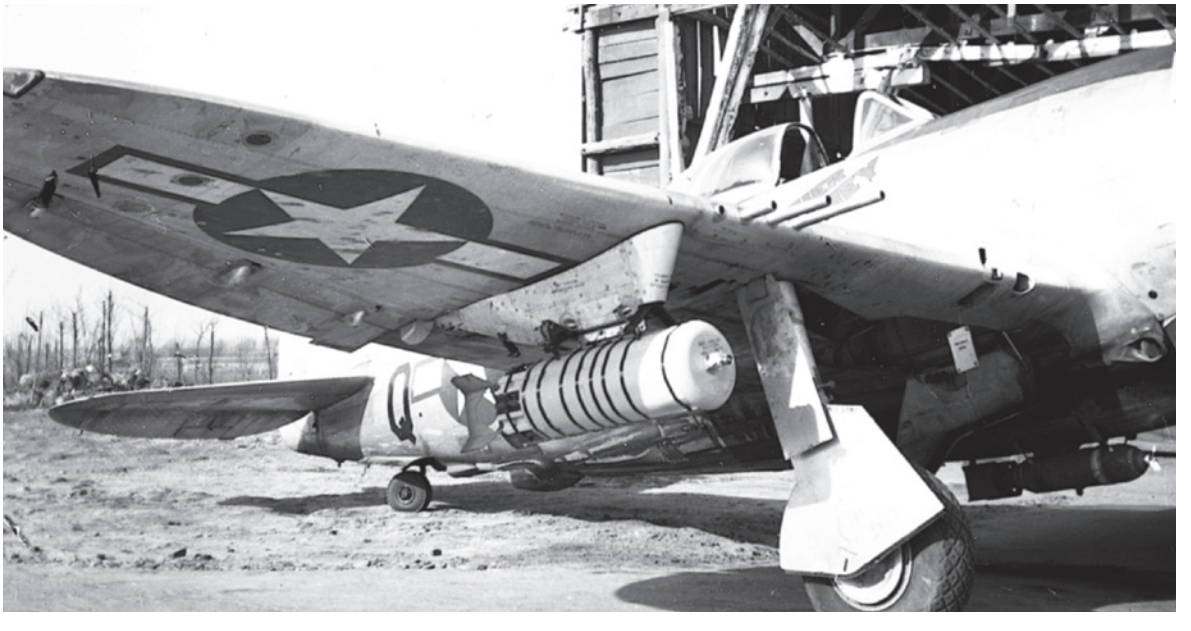
The standard M1 cluster adapter held six M41s. This Thunderbolt has five full clusters, or 30 bombs, mounted to the centerline stores pylons. (USAAF)

One of the more unusual pieces of ordnance hung under a Thunderbolt's wing was this M10A1 cluster adapter, which contained 104 AN-M50A2 incendiary bombs. The aircraft is also carrying a single AN/M57 250lb weapon on its centreline. (Author's Collection)

However, several other weapons were essential components of the Thunderbolt's arsenal. While GP bombs used a combination of explosion, concussion and fragmentation for effect on a target, fragmentation bombs were designed specifically to explode into hundreds of small fragments to maximize lethality against exposed personnel, livestock and unarmored vehicles. A common Thunderbolt loadout consisted of a pair of AN/M64 500lb GP bombs under the wings and a single AN/M81 260lb fragmentation bomb on the centerline.

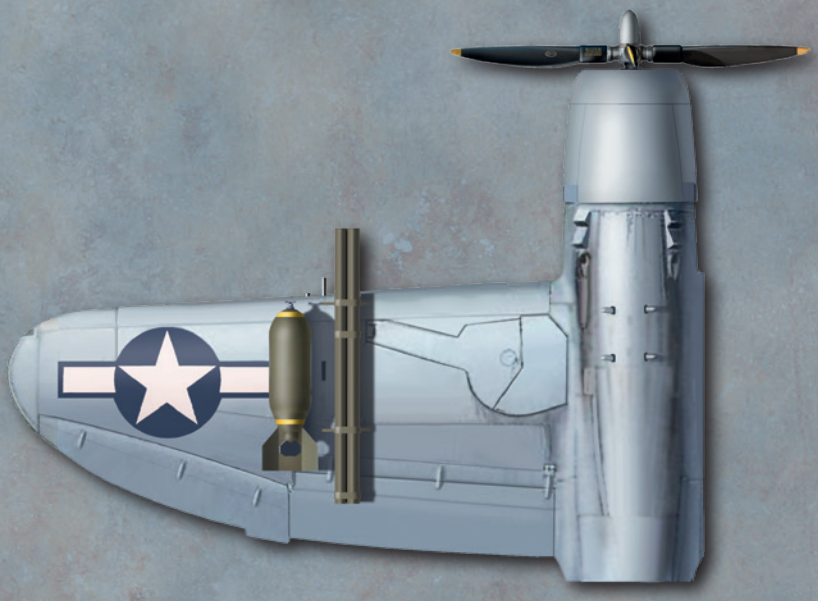
While the AN/M81 weighed 260lb, the ratio of explosive filler weight to bomb casing weight was significantly different from the GP bombs. The M81 only contained 34lb of TNT, and the remainder was a bomb casing designed to break apart into 6,000-7,000 high-speed fragments upon detonation, shredding any unarmored target on which it was dropped.

Along with the AN/M81, P-47 pilots also had the 20lb AN/M41 fragmentation bomb at their disposal. Six M41s were typically mounted on an M1 or M1A1 cluster adapter, and when dropped from 5,000ft, they would cover an area roughly 325ft long and 120ft wide with up to 6,000 bomb fragments. In typical USAAF fashion, Ninth Air Force armorers often devised field modifications to allow even more "frag clusters" to be carried, sometimes mounting as many as five M41s (weighting roughly 650lb) on a centerline rack when the intended targets were "troops in the open." Fragmentation bombs were particularly effective against exposed flak crews. GP and fragmentation bombs could be employed against most targets the Thunderbolt would encounter.



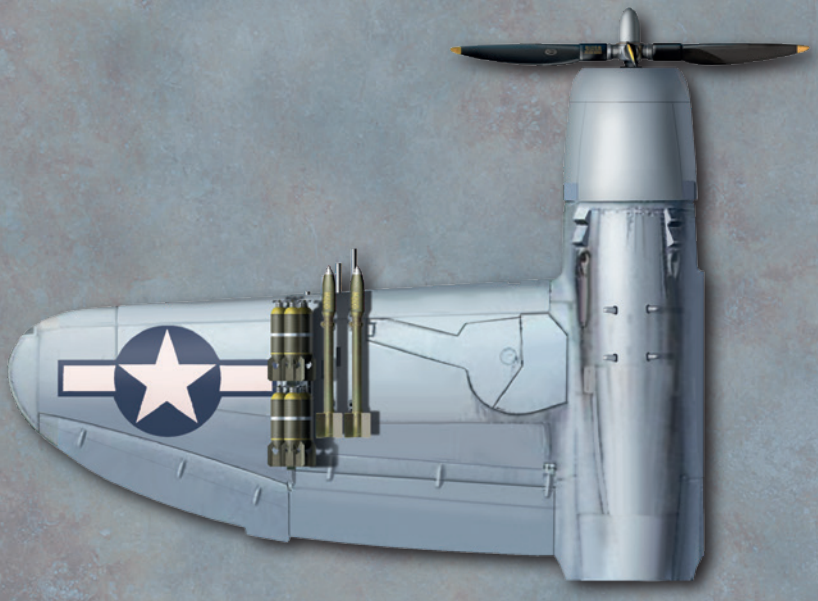
M8 Rockets and AN/M64 Bomb

First appearing on VIII FC P-47Ds in the late spring of 1944, the M8 4.5in. triple rocket tube gave the aircraft the equivalent punch of an artillery battery. M8 tubes were mounted inboard of the pylons, enabling a pair of AN/M64 500lb GP bombs to be carried too.



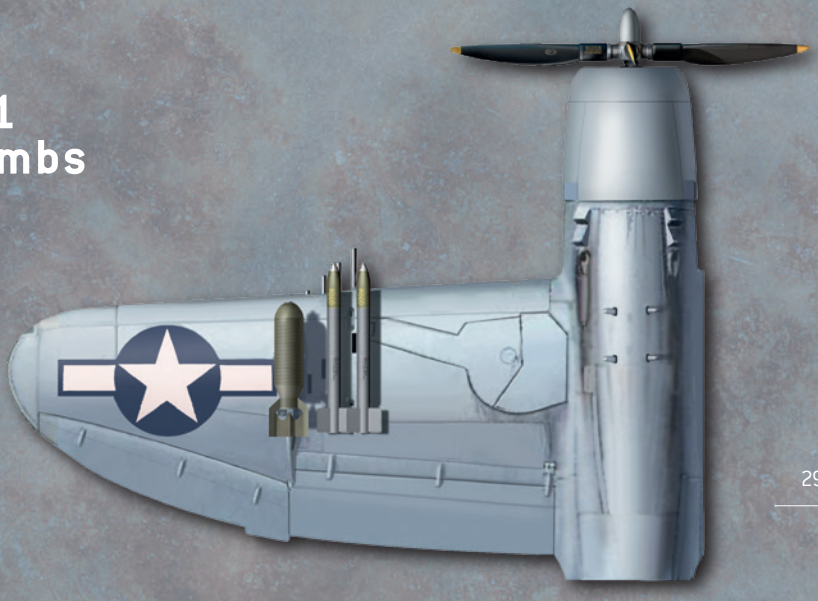
FFARs and M27 Cluster Bombs

Later in the summer of 1944, the 5in. FFAR was introduced, being mounted on stubs under the wings. This Thunderbolt is also armed with a pair of M27 500lb cluster bombs, consisting of six 90lb AN/M82 fragmentation bombs. Flak crews were rightfully fearful of P-47s armed with "frags."



HVARs and AN/M81 Fragmentation Bombs

The USAAF enjoyed significant success with fragmentation bombs of several types. One of the larger such weapons was the AN/M81 260lb bomb, which was frequently carried along with a pair of 500lb GP bombs or, as seen here, 5in. HVARs. The latter improved on the shortcomings of the FFAR, providing more thrust and a flatter trajectory due to its a larger motor.



At first glance, this 512th FS/406th FG Thunderbolt appears to be carrying a standard 150-gallon belly tank, but the pair of M52 2lb incendiary bombs secured to it verify that this is in fact a 150-gallon napalm tank. P-47D-28-RE 44-19584 was shot down by flak while strafing vehicles near Zierverich, Germany, on February 13, 1945. (Author's Collection)

The most feared weapon in the P-47's arsenal was the firebomb, the aircraft being capable of carrying either napalm tanks or incendiary cluster bombs – the latter were was far less common, however. Napalm was a jellied gasoline compound made with powdered aluminum and palmitic and naphthenic acids. It was designed to ignite on impact and then flow into low-lying areas like trenches and bunkers. Thunderbolt groundcrews used standard 75-, 108-, 110-, 150- or 165-gallon external fuel tanks, filling them with the inflammable mixture. The method of ignition depended on the type of tank used and whether it was fitted with a fuse. The AN/M69 6lb incendiary cluster came with its own integral fusing.

Napalm had a significant effect on the morale of ground troops. Burning at between 800-1,000 degrees Fahrenheit, it was exceedingly difficult to remove once in contact with the skin. While napalm bombs were particularly detrimental to the morale of German flak crews, the Thunderbolt pilot still had to maneuver within range of the anti-aircraft guns in order to get his bombs precisely on target, exposing himself to ground fire and the chance of getting shot down. A standoff weapon was needed to hit targets like flak emplacements from longer ranges.

Following the US Navy's lead, the USAAF began developing air-to-ground rockets in late 1943, and by the spring of 1944 it had introduced both the M8 4.5in. fin-stabilized, tube-launched rocket, and the 5in. Forward Firing Aerial Rocket (FFAR).

The M8 4.5in. rocket was loaded into triple tube launchers mounted inboard of the wing pylons. These "bazooka tubes" were developed from the US Army's 4.5in. artillery rocket launchers, but were made from either aluminum or fiberglass to save weight. The rockets were modified as well. The original artillery rockets were spin stabilized, which would limit their accuracy when launched from a moving aircraft. The M8 rockets had a different rocket nozzle and eight fins that popped out as the weapon emerged from the launch tube.

Although the M8 had decent standoff range, it was relatively inaccurate, which meant the rocket was really only useful as an area weapon. The rocket's destructive

Although they hampered maneuvering, the M8 4.5-in. tube-launched air-to-ground rockets were used regularly by the Twelfth Air Force as a standoff air-to-ground weapon. They were rarely seen in the ETO, however. (Author's Collection)

power was roughly equivalent to a 120mm high explosive mortar round, so several M8s striking closely together could be devastating. Pilots found that the closer they were to the target before launch, the better their chances of scoring a hit. Unfortunately, closing with the target negated that standoff range they sought.

The 5in. FFAR was a larger, faster alternative to the tube-launched M8 rockets. Thunderbolts fitted with rocket launch stubs could carry four 5in. FFAR in addition to a normal bombload. Unlike the M8 rockets, these required no launch tubes, and were free from the carrier aircraft as soon as they were fired. The first type introduced in the summer of 1944 was based on the US Navy's 3.25in. Mk 7 rocket motor, and carried a 5in. warhead. With a speed of more than 800ft per second, the rocket was relatively slow. Coupled with the larger warhead, the FFAR tended to fall short of the intended target, dropping significantly upon release from the firing aircraft.

The Mk 7's flaws had been corrected by the end of 1944 with the introduction of the High Velocity Aircraft Rocket (HVAR), which coupled the 5in. warhead with a new rocket motor that provided enough thrust and mass to make it a far more accurate and capable weapon with a credible standoff range.

P-47D-27-RE 42-27365 *BOBBY SNOOKS* is armed with a pair of 5-in. FFARs and an AN/M64 500lb GP bomb under each wing, as well as eight 0.50-cal. machine guns. (Author's Collection)

A lone GI familiarizes himself with the controls of an abandoned Flakvierling 38. (Author's Collection)

FLAK DEFENSES

According to *General der Flakartillerie* Walther von Axthelm during his post-war interrogation on June 28 1945, "In the field of light and medium flak, the 2cm was replaced by the 3.7cm FlaK 43. The replacement, however, was extremely slowed down by difficulties in the manufacture of the 3.7cm FlaK 43, so that the plan of the General of Flak, namely, to replace all 2cm by the 3.7 FlaK 43, failed. The other plan to replace the 3.7 with the 5cm or 5.5cm failed also, as Hitler prohibited both the development of the 5cm, which had been produced in an initial series of 50 pieces, and the development of the 5.5cm. This was done because of objections raised by the Ministry for Armament, particularly by [Karl-Otto] Saur."

Production of light and medium flak guns was critical to the war effort of the Third Reich, but Germany's industrial heartland was completely overtaxed by 1944. Widespread use of slave labor, lack of significant production automation and

inferior materials, coupled with wasteful and time-consuming production methods, ensured that developing new systems would be nearly impossible at a time when they were needed most.

The Wehrmacht had quickly mechanized its flak forces in order to better ensure their survival, but the guns they used never quite caught up. The Flakvierling 38 was statistically the most important light flak weapon employed by the *Flakwaffe*, having the best combination of rate and weight of fire and reliability. Its 2cm 20x138mmB Sprenggranatepatrone (High-Explosive Tracer) ammunition was effective up to a distance of roughly 2,000 yards, at which point the tracer burned through the projectile, detonating the high explosive within and throwing out a spray of shell fragments.

Flakvierling 38 Specification	
Caliber	2cm
Barrel length	4ft 7in
Weight	1.6 tons
Effective ceiling	3,500ft
Maximum horizontal range	5,230 yards
Rate of fire	700-800 rounds per minute
Muzzle velocity	2,950ft per second
Traverse	360 degrees
Elevation	-10 to +100 degrees

Sprenggranate Patronen 18

The Sprenggranate Patronen 18 was the principal high explosive 3.7cm round used by the FlaK 18, FlaK 36 and FlaK 43 weapons. The projectile, which was five inches long, was filled with 0.856oz of PETN/wax explosive and capped by a 3.7cm Kopfzunder Zerl PV mechanical, self-destroying fuse.

Germany's first 3.7cm weapon was also developed from a Solothurn design. The FlaK 18 was modified from the S10-100 and adopted by the Wehrmacht in the mid-1930s. It had several operational issues, however, and necessitated a redesign that produced the FlaK 36/37 3.7cm gun that Germany took to war in September 1939. Most notably, it relocated the gunner's seat from the left side of the weapon to the right rear, thus giving him a much better view and allowing the gun to be fitted with a much more effective barrel and sight elevation system. The ammunition remained unchanged between the two gun types.

The Flak 36/37 primarily fired the Sprenggranatepatrone 18 round – a high-explosive projectile filled with 10.8oz of Pentaerythritol tetranitrate, which made up nearly half the projectile's weight. Although less common in the antiaircraft role, it was also capable of firing the armor-piercing Panzergranatepatrone 18, which had a reduced explosive charge in exchange

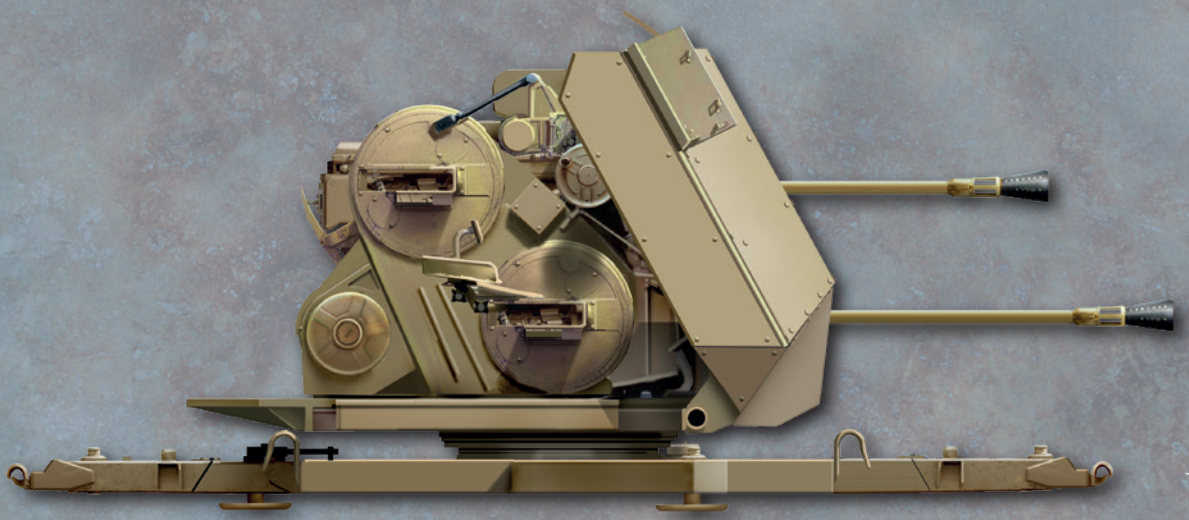
Although few in number, the Sd.Kfz. 7/2 upgraded with the FlaK 43 3.7cm gun was one of the most dangerous platforms Thunderbolt pilots would face when attacking targets on the continent in the wake of the Normandy landings. (NARA)

for greater penetrating mass. Ammunition was loaded into six-round clips that would be fed into the left side of the gun. The FlaK 43, introduced in early 1944, used the same ammunition, but utilized an eight-round clip instead due to its greater rate of fire.

While it never fully overcame development and production issues, the FlaK 43 was Germany's most effective light/medium anti-aircraft gun of the war. Excellent

FlaK 43 Zwilling

The FlaK 43 Zwilling 3.7cm weapon was arguably the best all-round battlefield antiaircraft gun fielded by the Wehrmacht. Its sustained rate of fire, range and hitting power, coupled with excellent computing sights, made it devastating against aircraft flying at low- to medium-altitude.



computing sights, coupled with a high rate of fire, rapid traverse/elevation speed and powerful armor-piercing and high explosive ammunition made it extremely deadly against single-engined fighters. A solitary hit from a 37mm round was enough to bring a Thunderbolt down. However, by VE Day, fewer than 1,100 single and 400 Zwilling mounts had been produced.

FlaK 43 Specification	
Caliber	3.7cm
Barrel length	10ft 8.75in
Weight	2 tons
Effective ceiling	5,000ft
Maximum horizontal range	7,200 yards
Rate of fire	160 rounds per minute (actual), 250 rounds per minute (theoretical)
Muzzle velocity	2,750ft per second
Traverse	360 degrees
Elevation	-6 to +90 degrees

The introduction of the Mauser MG 151 aircraft cannon as a flak weapon presented a series of new challenges for the *Flakwaffe*. The initial Flak MG 151s were older 15mm variants, which fired a smaller projectile than their 20mm counterparts. This temporarily alleviated the competition for ammunition between the *Flakwaffe* and *Jagdwaffe* (fighter force) and allowed the MG 151/15 to be developed as a flak weapon. However, production of 15mm ammunition shifted to the more capable 20mm round in 1942 and the MG 151/15 flak guns were forced to convert to the larger caliber shell within a matter of months.

The ammunition feed system on this rail car-mounted MG 151/20 Flakdrilling is clearly visible here. While the center gun fed smoothly from the central magazine, the belts feeding the outer two guns would have to rotate through 90 degrees before feeding shells into the weapon, resulting in a high jam rate. (EN Archive)

Although a 2cm weapon, the MG 151/20 fired a different cartridge from the FlaK 38. The 2cm 82 cartridge was significantly shorter than the 2cm 20x183mmB, which meant that the established logistics trains to keep ammunition supplied to flak units had to be altered to include the new rounds. The MG 151's rate of fire was also significantly higher, so more consistent and larger resupplies were required. The challenges facing the Wehrmacht's transportation network from early 1944 due to the increasing number of Thunderbolts present overhead, coupled with the *Jagdwaffe* having priority for MG 151/20 ammunition, meant the Mauser was a rarity within the *Flakwaffe*, despite the clear advantages it possessed when it came to protecting ground forces.

MG 151/20 Specification	
Caliber	2cm
Barrel length	5ft 8in
Weight	gun alone 84lb; triple mount with armor plating 450lb
Effective ceiling	5,000ft
Maximum horizontal range	2,187 yards
Rate of fire	750 rounds per minute
Muzzle velocity	2,600ft per second
Traverse	360 degrees
Elevation	-6 to +85 degrees

The MK 103 3cm cannon was introduced into frontline service in 1943 as the main "tank-busting" armament of the Henschel Hs 129 attack aircraft. The gun had an excellent rate of fire, and the 3cm high-velocity armor-piercing round showed good effect against most types of Allied armor. The Luftwaffe sought to use the MK 103 in other fighter types, specifically aircraft assigned to the bomber destroyer mission.

FlaK 103/38 Jaboschreck

Although this weapon appeared very late in the war, the 3cm FlaK 103/38 Jaboschreck corrected many of the flaws that had afflicted the long-serving 2cm FlaK 38. It incorporated the proven MK 103 aircraft cannon and a new ammunition feed system that finally eliminated the 20-round box magazine which had hampered the FlaK 38's performance. Although the FlaK 103/38 outperformed the FlaK 38 in all areas, examples of the weapon had only just begun to reach frontline units when the war ended.

These captured FlaK 103/38s were collected by US Army troops of occupation in Germany shortly after VE Day. The 3cm weapon had the potential to wreak havoc when used against Allied fighter-bombers, but thankfully for P-47 pilots it was just coming into service as the war in Europe came to an end. (NARA)

However, the gun was too large and heavy, and the recoil forces too significant, for it to be effectively used by a fighter the size of the Fw 190 or Bf 109. The shorter, lighter MK 108 was duly developed from the MK 103, and although it fired a cartridge of reduced length at a significantly lower muzzle velocity, it was far better suited for fitment into fighters. As a result, only heavy fighters like the Me 410B-2 and prototypes of the Do 335 and Ta 152C were still using the MK 103 by late 1944.

Rheinmetall was asked to adapt the gun for the flak role, and by the fall of 1944 the firm was modifying obsolete FlaK 38 mounts to accept the new gun. The standard mount needed significant modification to handle the increased weight and recoil forces of the MK 103. As an aircraft cannon, the MK 103 ejected spent casings downward, so the center of the FlaK 38 mount base had to be removed to allow empty casings to fall to the ground. Gun crews had to be mindful of shells building up beneath the gun mount during sustained firing operations, or risk interfering with the weapon's traverse.

The FlaK 103/38 was just coming into service as the war came to an end. Although 3,000 guns had been planned, it is uncertain how many had reached combat units by VE Day.

The FlaK 103/38's 3cm 30x184B round was devastating due to both its high muzzle velocity (3,100ft per second for armor piercing rounds) and its high explosive fill. As with the larger 37mm round, one hit was usually enough to bring down a fighter. But while the FlaK 43 expended 160 rounds per minute, the 3cm "Jaboschreck" (fighter-bomber terror) fired at three times that rate. The FlaK 103/38 had the potential to be a truly devastating weapon in the hands of an experienced Flak crew. The Jaboschreck also greatly reduced one of the vulnerabilities of belt-fed antiaircraft guns at extreme elevation. As the gun elevates, the belt and feed chute protruding from a fixed ammunition container twists, greatly increasing the potential for jamming. By mounting the FlaK 103/38's ammunition box on the side of the elevation ring, the ammunition container elevated with the gun, thereby keeping the ammunition belt flat and ready to feed into the weapon.

Had Germany focused on its antiaircraft guns a year earlier, it could have potentially changed the face of the air war in the ETO with weapons like the FlaK 103/38.

Despite both fronts crumbling and defeat an inevitability, Germany's war production industry continued churning out antiaircraft guns at a significant pace into the spring of 1945. The increased capability and lethality of the newer systems were offset by the lack of trained, experienced crews to man them.

THE STRATEGIC SITUATION

By January 1944, it was apparent to the Oberkommando der Wehrmacht West that the Allies would have to open another front in Europe. The stalemate near the Anzio beachhead in Italy, coupled with increasing diplomatic pressure from the Soviet Union, made this an inevitability. With Lt Gen Doolittle releasing VIII Fighter Command to hunt the Luftwaffe on their airfields, and the Twelfth Air Force in Italy just starting to unlock the P-47's potential as a fighter-bomber, things began to swing in the Allies' favor. However, the *Flakwaffe* held a slight advantage as 1944 dawned and the USAAF commenced low-altitude Thunderbolt operations in earnest. That would shift dramatically as the year progressed.

Kriegsmarine coastal flak batteries were improved and reinforced significantly during the first months of 1944, resulting in a virtual belt of antiaircraft defenses – including everything from the lightest to the heaviest guns in the German inventory – encircling the French coast from Normandy to Provence. With the new opportunity to engage marauding USAAF Thunderbolts at low-altitude, Luftwaffe light flak units protecting airfields also began scoring an increasing number of victories from early 1944. Indeed, the steadily rising tally of kills attributed to gunners quickly became comparable to the aerial victory claims being credited to *Jagdwaffe* pilots. Combat-experienced light and medium flak units from the Eastern Front also arrived in France in small numbers from the early spring.

The end of 1943 included a massive reorganization of the European and Mediterranean Theater Air Forces, with the Ninth Air Force headquarters moving from North Africa to England and shifting its focus from a strategic to a tactical air

OPPOSITE
This map of Western Europe shows the disposition of German flak batteries on the eve of Operation *Overlord* in June 1944.

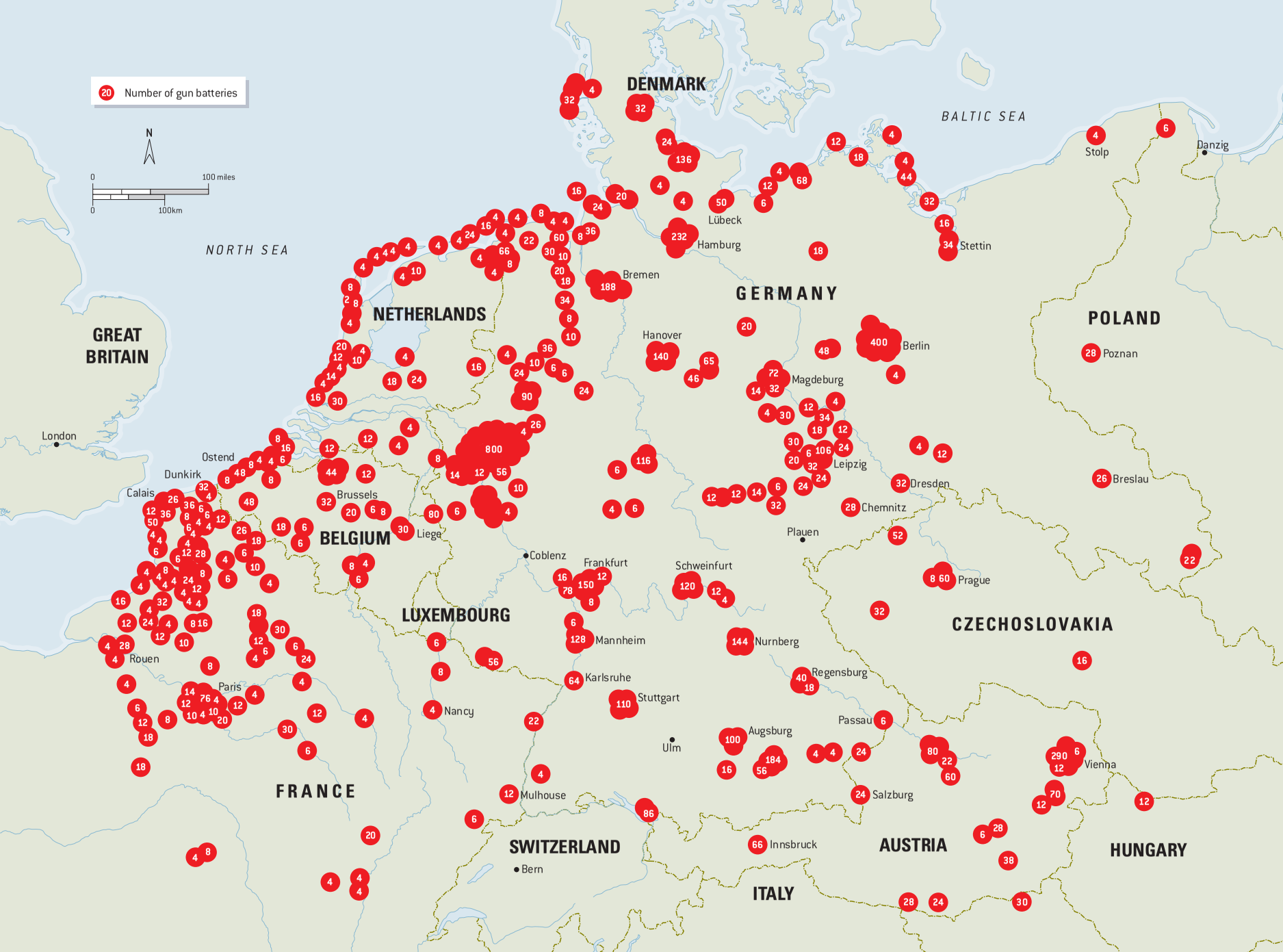
force. Conversely, the Fifteenth Air Force stood up in the Mediterranean, taking on the strategic role and complimenting the tactical Twelfth Air Force. Considering only two Fifteenth Air Force groups (the 325th and 332nd FGs) flew the P-47, and then only for a short period of time, they are outside the scope of this work.

INVASION PREPARATION

The early months of 1944 saw the number of USAAF P-47 groups in England double with the arrival of Ninth Air Force units from the US. The Eighth Air Force started transitioning to the P-51B/C in late 1943, and by January the 4th FG was operational with the new long-range fighter. Although four more VIII Fighter Command groups would begin transitioning in the spring, a similar number would retain their Thunderbolts well into the year. Along with the 13 P-47 groups that would initially form IX Fighter Command, the remaining four Eighth Air Force Thunderbolt units would also be heavily engaged in ground attack operations throughout the spring and summer of 1944.

In the lead up to the D-Day invasion, USAAF planners divided air operations into three distinct phases. Although unintended, the P-47 became a critical component of all three phases. The seizure and retention of air superiority over Western Europe was considered to be the First Phase. While the long-range P-51 was able to take the fight deep into Germany and escort the Eighth Air Force's heavy bombers all the way to

Brand new P-47D-22-REs bookend two veteran D-6s at Base Air Depot 1 (RAF Burtonwood) in April 1944. The factory-fresh Thunderbolts were destined for service with Ninth Air Force fighter groups in the weeks leading up to D-Day. (NARA)


20 Number of gun batteries
N
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NORTH SEA
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DENMARK
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POLAND
BELGIUM
LUXEMBOURG
FRANCE
SWITZERLAND
AUSTRIA
HUNGARY
ITALY
CZECHOSLOVAKIA
London
Ostend
Dunkirk
Calais
Brussels
Liege
Rouen
Paris
Coblenz
Frankfurt
Mannheim
Karlsruhe
Stuttgart
Nancy
Mulhouse
Bern
Schweinfurt
Nurnberg
Regensburg
Augsburg
Ulm
Passau
Salzburg
Innsbruck
Lübeck
Hamburg
Bremen
Hanover
Berlin
Magdeburg
Leipzig
Dresden
Chemnitz
Plauen
Stolp
Danzig
Stettin
Poznan
Breslau
Prague
Vienna

their targets and back, control of the skies over the Third Reich in particular would not become reality until the summer of 1944.

Although the Second Phase effectively began when VIII Fighter Command units were given permission to actively hunt the *Jagdwaffe* by attacking their airfields, its real intent was to isolate the battlefield by targeting the transport infrastructure, including roads, bridges, railways and any mode of transportation that could bring men and equipment to the frontlines. Both the Eighth and Ninth Air Forces began Second Phase operations in early 1944 in order to isolate the Wehrmacht in France and cut it off from its vital logistics lifeline to the Fatherland.

Again, the boundaries between all three phases are somewhat blurred. Technically, Third Phase operations began when infantry boots hit the shores of Normandy on June 6, 1944, after which coordination between air and ground units was essential. However, Ninth Air Force P-47s were attacking troop concentrations, motor transport and gun emplacements on the continent well in advance of the first Allied soldiers reaching Normandy.

In early 1944, the latest model Thunderbolt was the P-47D-15-RE, which was the first variant to reach frontline units with factory-installed wing pylons. Many early Ninth Air Force P-47s were, however, older hand-me-down aircraft that the Eighth Air Force had been flying for several months. As a result, most IX Fighter Command groups entered combat in the spring of 1944 with a mix of Thunderbolt variants, including a handful of year-old P-47C-2/5 airframes. While the C- and early D-models did not have wing pylons, they were stable gun platforms for strafing, and their centerline rack could carry a 500lb GP bomb. They had all been replaced by newer aircraft by the end of the summer of 1944, although a few continued serving as squadron hacks through to war's end.

As VIII and IX Fighter Commands (the latter renamed IX TAC in April 1944) built up their units for the upcoming invasion, Army Group B under Generalfeldmarschall Erwin Rommel was preparing as well. By June 6, 1944, there were 36 German divisions in Normandy, including 25 infantry divisions, three SS Panzer divisions, two panzer divisions, three *Fallschirmjäger* and three Luftwaffe field divisions. The most common flak unit among these formations would be the Panzerjäger Abteilung, a dual-role battalion that provided both antitank and antiaircraft defense for German infantry divisions.

Each Panzerjäger battalion would be equipped with 12 2cm FlaK 38 antiaircraft guns or possibly nine 3.7cm FlaK 36 weapons. Conversely, the SS Panzer divisions were far more adequately prepared for the *Jagdbomber* threat. The 1st, 12th and 17th SS Panzer Divisions were each equipped with 114 2cm FlaK 38 self-propelled antiaircraft guns, eight 3.7cm FlaK 43 self-propelled guns and 12 8.8cm heavy flak guns to address any potential airborne threat. The Wehrmacht's Panzer divisions were only slightly less heavily armed, with 74 2cm, eight 3.7cm and eight 8.8cm guns assigned.

This camouflaged Sd.Kfz. 7/1 flak halbkette was assigned to III. *Flakkorps* during the summer of 1944. The unit consisted of four flak regiments, each one of which was equipped with 18 halbkette armed with four-barrel Flakvierling 38 2cm guns. With the regiments being fully mechanized, they could, in theory at least, rapidly move antiaircraft guns such as this Sd.Kfz. 7/1 to where they were needed most on the battlefield. (EN Archive)

P-47D-16-REs from the 378th FS/362nd FG await their next mission at the newly created advanced landing ground at Lignerolles (A-12), in Normandy, shortly after D-Day – the unit flew in here from Headcorn on July 2, 1944. The jerrycans in the foreground are being used to fill the refueling bowser to the left of the photograph – a laborious and potentially dangerous job. Once filled, the bowser would be towed out to the flightline and its contents rapidly pumped into the fighters' tanks. The majority of the groundcrew visible here are wearing their steel helmets, which indicates just how close the airfield was to the frontline. They expected little advanced warning should the Luftwaffe decide to mount a strafing attack. (NARA)

For most German divisions in Normandy, antiaircraft protection would be supplied by III. *Flakkorps*, but only one of its four flak regiments was in northwestern France on June 6. *Flak-Sturm Regiment* 1 (situated near Isigny-sur-Mer) and its sister regiments were highly mechanized and heavily armed, each with 30 FlaK 38s, 18 four-barrel Flakvierling 38 2cm guns and 12 8.8cm weapons. Being fully mechanized, the regiment, in theory, could rapidly move antiaircraft guns to where they were needed most on the battlefield.

On June 6, 1944, XI Fighter Command flew 2,148 sorties in support of the invasion. The overwhelming majority of these flights were made by its 13 Thunderbolt groups. Pilots flew multiple missions on D-Day, cutting railway lines, hitting troop concentrations and preventing reinforcements from reaching the beachhead. The following day proved to be even more intense, with nearly 2,600 sorties (almost ten percent of the month's operational tally!) flown in support of advancing Allied troops. In all, the Ninth Air Force would fly nearly 29,000 tactical sorties in June 1944 in support of 1st Army. That same month the Eighth and Ninth Air Forces would lose a combined total of 190 P-47s to all causes. Flak would account for 86 of those aircraft, with 42 falling to enemy fighters and the remaining 62 being brought down by mid-air collisions, flying through one's own bomb blast, mechanical issues and unknown causes.

On June 14, the initiative shifted dramatically against the defending forces when the 368th FG set up operations at airfield A-3 near Cardonville, in France. By the first week of August, 13 Thunderbolt groups from the Ninth Air Force were operating from forward airstrips in Northern France. The P-47, along with the Allied armies they were tasked to support, would not be dislodged from the continent.

By then, the strategic situation had shifted significantly in the Allies' favor. With the western Allies firmly on the continent and pushing eastwards, and the Soviets bringing Operation *Bagration* to a close in the east, Germany was retreating on all fronts. The

This unidentified P-47D of the 378th FS/362nd FG, flown by 1Lt Andrew Sunter, was holed by flak just behind the cockpit during a mission from Lignerolles. Sunter was subsequently forced to bail out of his Thunderbolt near Vire on July 31 after attacking Tiger tanks. "On pulling off the target, I felt three distinct flak burst hits on my plane, my right foot was knocked off the rudder pedal and either pieces of floor or flak started rattling around the cockpit. I recovered control and thought I was alright until flames started spewing up around my legs and it got unbearably hot. I rolled my trim tab back, pulled the plane up to approximately 1,000ft, opened the canopy and dove out the right side." (NARA)

middle of August proved particularly disastrous in the west. In Northern France, the Americans, Canadians and British raced to encircle Army Group B as it retreated through the Falaise Pocket towards Germany. Among the Wehrmacht units trapped in the rapidly closing pocket was *Flak-Sturm Regiment* 1, which had enjoyed a modicum of success in Normandy. Army Group B was able to extricate roughly half of its total force, with 10,000 troops killed in action and 40,000 captured, while the remaining 50,000 were able to break through the encirclement and escape.

With the US 1st and 3rd Armies now operating on the continent, a second Tactical Air Command, XIX TAC, was established on August 1 in order to directly support Maj Gen George Patton's 3rd Army. IX TAC, under Maj Gen Elwood "Pete" Quesada, would continue direct support of Bradley's 1st Army. From this point forward, each US Field Army would have its own dedicated TAC.

On the Eastern Front, Army Group Center was not as lucky as Army Group B. That same week signaled its final destruction during Operation *Bagration*, resulting in the loss of about a quarter of all German manpower in-theater. More than 400,000 were killed, wounded or captured during the onslaught, and 37 of 41 divisions were destroyed.

On August 15, a few days prior to the end of both the Falaise Pocket offensive and *Bagration*, the US 7th Army and Free French Army B (renamed the French 1st Army the following month) invaded Southern France during Operation *Dragoon* and were able to seize the ports of Marseilles and Toulon within two weeks of the initial landing. According to the official 7th Army history, "the complete occupation of Toulon required the combined efforts of the French Army, XII TAC [27th, 86th and 324th FG, all equipped with Thunderbolts] and the Western Naval Task Force." The German 242nd Infantry Division fought fanatically to hold on to the port city. Flak units within Toulon were experienced veterans, and 28 XII TAC aircraft were hit and three destroyed while conducting close support missions during the retaking of the city. Both Toulon and nearby Marseilles were liberated on August 28 by Free French Army B. With the ports in both cities open, the Allies now had two additional avenues to bring supplies and reinforcements onto the continent.

Oddly, XII TAC operations were forced to go against doctrine after just a few days attempting to isolate the battlefield. Unlike in previous operations, and apart from the two divisions sacrificed in Toulon and Marseilles, the German 19th Army did not stay and fight other than in a series of quick delaying actions. Normally, XII TAC's P-47s and B-26s would have been hitting bridges, railway lines and other transportation infrastructure in order to isolate the battlefield. However, with the rapid retreat of 19th Army, the Allied armies instead raced up the Rhône river valley in an attempt to engage the retreating force before it was able to reach the Vosges mountains and reinforcements. On this occasion the bridges had to stay up so that the 7th Army could catch up!

The rapid advance up the Rhône river valley forced XII TAC's fighter-bombers into a difficult position. In the initial phase of the invasion, the 27th, 86th and 324th FGs were based on the Mediterranean island of Corsica, flying roughly 140 miles to support the invasion beachhead. XII TAC was still operating under the control of the Twelfth Air Force, based in Italy, with XXII TAC (57th, 79th and 350th FGs) also flying from Corsica on support missions over the Italian mainland. With the 7th Army advancing north at breakneck speed and XII TAC's Thunderbolts quickly reaching the edge of their effective combat radius, the decision was made to move all three groups to hastily constructed airfields in Southern France.

With the precedent set by IX and XIX TACs in Northern France, it was clear that XII TAC would have to be the supporting command for Lt Gen Alexander Patch's 7th Army. However, that meant splitting the Twelfth Air Force in two, leaving XXII TAC responsible for supporting the 5th Army in Italy. Just a few weeks later, the US 9th Army arrived in France and XXIX TAC was assigned for direct air support. By summer's end, Ninth Air Force had three TACs assigned and one under its operational control, making it the USAAF's largest operator of the P-47 with nearly 2,000 operational Thunderbolts on hand. The four US field armies had the integrated air cover necessary to press eastward toward Germany.

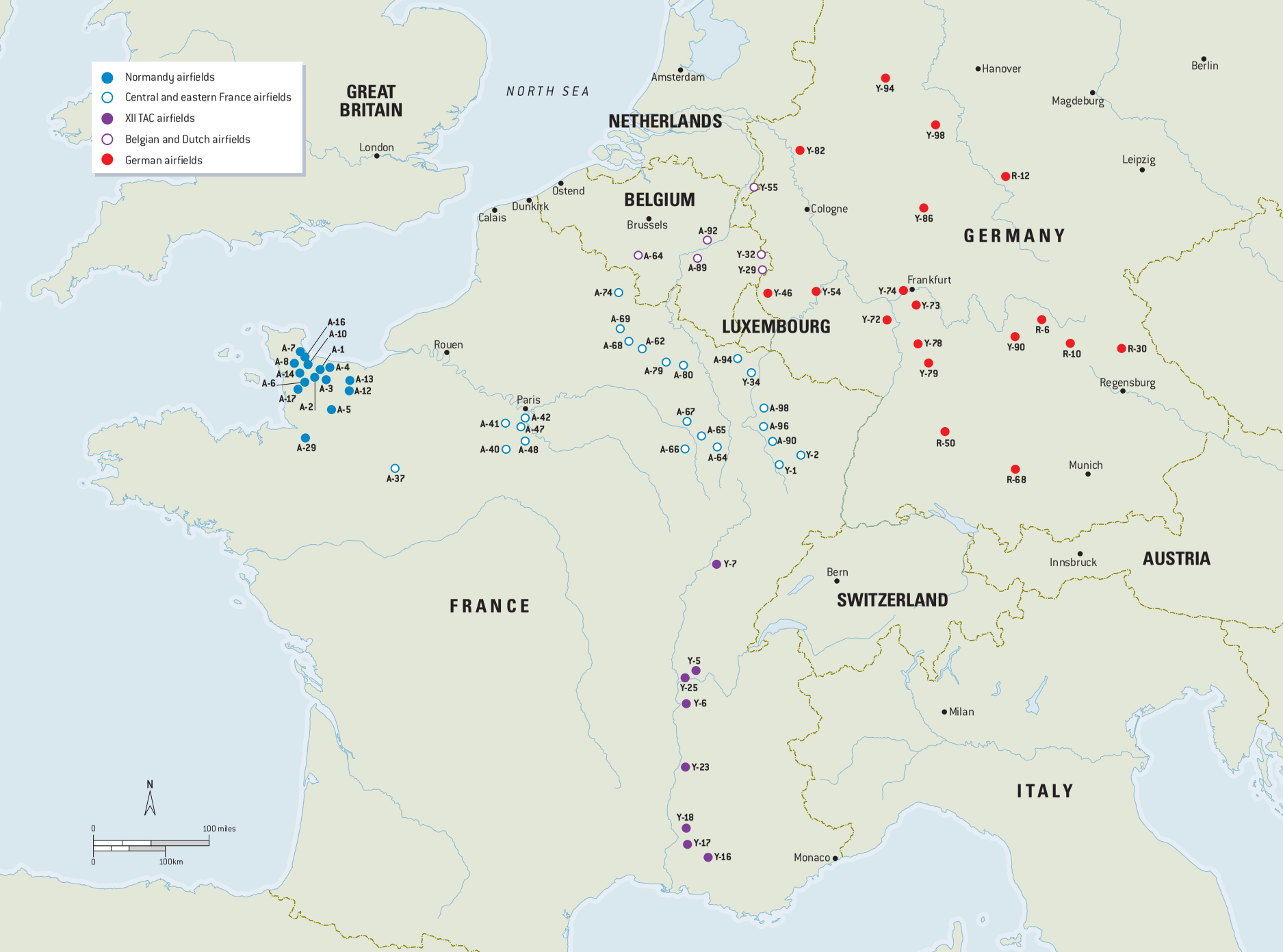
In order to provide better support to those field armies, the Ninth's Thunderbolt groups began moving to new airfields in eastern France and Belgium. Shortening supply lines was not as important as maintaining an air umbrella over US forces on the ground, and with the opening of the port of Antwerp in October, P-47 groups were often resupplied just as quickly as they had been when flying from airfields in western France.

By late fall, the lines had stabilized along the German frontier. The heaviest fighting was in the north, in the Hurtgen Forest and in territory occupied by the 9th Army. XXIX TAC provided the best air cover it could, but the terrain and heavily forested areas made the provision of effective ground support an almost impossible task. US forces were oriented roughly on a north/south line on the Dutch, French, Luxembourg and Belgian borders, with the 9th Army northernmost, followed by 1st, 3rd and 7th Armies traveling southward.

Meanwhile, new US Army divisions were moving into the line further south in the Ardennes sector. The combat-proven 2nd and 28th Infantry Divisions had occupied defensive positions, and were joined by the yet untested 99th and 106th Divisions. The initiative was to shift drastically in the early hours of December 16, when the German 5th and 6th Panzer Armies launched a massive assault on American positions in the Ardennes. The counteroffensive came to be known as the Battle of the Bulge. The weather steadily deteriorated on the 16th, making flying difficult for the next 72 hours. Several fighter groups were not even made aware of the situation until the following day.

While the Ninth Air Force tallied 647 sorties on December 17, the Luftwaffe launched just as many with the specific intent of countering

This image reveals the level of destruction achieved by Allied tactical air power, and specifically fighter-bombers, when sent against retreating Wehrmacht troop columns during the Battle of the Falaise Pocket on August 18–21, 1944. In full retreat, the Germans lost thousands of vehicles when they were either destroyed by the enemy or abandoned due to a lack of fuel. Mechanized flak batteries are conspicuous by their absence in this photograph, taken by an RAF Spitfire PR XI. (NARA)


Normandy airfields
Central and eastern France airfields
XII TAC airfields
Belgian and Dutch airfields
German airfields
GREAT BRITAIN
NORTH SEA
NETHERLANDS
BELGIUM
LUXEMBOURG
GERMANY
FRANCE
SWITZERLAND
AUSTRIA
ITALY
London
Amsterdam
Hanover
Berlin
Magdeburg
Leipzig
Ostend
Dunkirk
Calais
Brussels
Cologne
Frankfurt
Rouen
Paris
Regensburg
Munich
Innsbruck
Bern
Milan
Monaco
A-16
A-10
A-7
A-1
A-8
A-4
A-14
A-13
A-6
A-3
A-12
A-17
A-2
A-5
A-29
A-37
A-41
A-42
A-47
A-40
A-48
A-92
A-64
A-89
A-74
A-69
A-68
A-62
A-79
A-80
A-94
A-34
A-67
A-65
A-66
A-64
A-98
A-96
A-90
Y-2
Y-1
Y-94
Y-98
Y-82
Y-55
Y-86
R-12
Y-32
Y-29
Y-46
Y-54
Y-74
Y-73
Y-72
R-6
Y-78
Y-90
R-10
R-30
Y-79
R-50
R-68
Y-7
Y-5
Y-25
Y-6
Y-23
Y-18
Y-17
Y-16
N
0
100 miles
0
100km

(Note that only airfields occupied by P-47-equipped groups are marked on the map)

A-1 – Saint-Pierre-du-Mont
A-2 – Criqueville-en-Bessin
A-3 – Cardonville
A-4 – Deux-Jumeaux
A-5 – Chippelle
A-6 – Beuzeville-la-Bastille
A-7 – Azeville
A-8 – Picauville
A-10 – Carentan
A-12 – Lignerolles
A-13 – Tour-en-Bessin
A-14 – Cretteville
A-16 – Brucheville
A-17 – Méautis
A-27 – Rennes/Saint-Jacques
A-28 – Pontorson
A-29 – Saint-James
A-35 – Le Mans
A-36 – Saint-Léonard
A-37 – Lombron
A-40 – Chartres
A-41 – Dreux/Vernouillet
A-42 – Vélizy-Villacoublay
A-44 – Peray
A-45 – Lonrai
A-47 – Orly
A-48 – Brétigny
A-62 – Reims/Champagne
A-64 – Saint-Dizier/Robinson
A-65 – Perthes
A-66 – Orconte
A-67 – Vitry-En-Artois
A-68 – Juvincourt-et-Damary
A-69 – Laon/Athies
A-70 – Laon-Couvron
A-74 – Cambrai/Niergnies
A-76 – Athis
A-79 – Prosnes
A-80 – Mourmelon-le-Grand
A-82 – Verdun/Etain
A-84 – Chièvres
A-89 – Le Culot
A-90 – Toul-Croix De Metz
A-92 – Sint-Truiden
A-96 – Toul/Ochey
A-98 – Rosieres en Haye
Y-1 – Tantonville
Y-2 – Luneville
Y-5 – Ambérieu-en-Bugey
Y-6 – Lyon/Bron
Y-7 – Dôle/Tavaux
Y-12 – St. Raphael/Frejus
Y-16 – Salon
Y-17 – Istres/Le Tube
Y-18 – Le Vallon
Y-23 – Valence
Y-25 – Lyon/Loyettes
Y-29 – Asch
Y-32 – Ophoven
Y-34 – Metz
Y-46 – Aachen
Y-54 – Kelz
Y-55 – Venlo
Y-62 – Mendig (Niedermendig)
Y-73 – Frankfurt/Rhein-Main
Y-74 – Frankfurt/Eschborn
Y-78 – Biblis
Y-79 – Mannheim/Sandhofen
Y-86 – Fritzlar
Y-90 – Giebelstadt
Y-94 – Munster/Handorf
Y-98 – Lippstadt
R-6 – Kitzingen
R-10 – Illesheim
R-12 – Kassel/Rothwesten
R-30 – Fürth/Industriehafen
R-50 – Stuttgart/Echterdingen
R-68 – Straubing

any *Jabos* that may target German ground forces. They were very successful in doing so, and while the Thunderbolt pilots they encountered eagerly turned to face them, and shot down several Bf 109s and Fw 190s, the *Jagdwaffe*'s primary mission of forcing the P-47s to jettison their bombs and engage the German fighters was achieved.

However, as the American frontline stabilized with the return of better weather, the Wehrmacht was unable to reach its objective and capture Antwerp, nor were the Panzers able to split the Allied armies. By the 19th, strategically speaking, the ground campaign was lost for Germany, even if the fighting did not reach its highest intensity until the second week of January.

On New Year's Day, the Luftwaffe launched Operation *Bodenplatte* – an all-out aerial attack with nearly 1,000 aircraft on Ninth Air Force airfields in France and Belgium, with the *Jagdwaffe* determined to destroy as many fighter-bombers on the ground as possible. Due to a combination of faulty navigation, Thunderbolts already in the air and heavy American antiaircraft fire, only three of the Ninth's P-47 airfields were effectively targeted – Asch (366th FG), Metz (365th FG) and Sint-Truiden (48th and 404th FGs). The attacking forces that reached Metz destroyed 22 Thunderbolts on the ground and damaged 11 more. Things were slightly better at Sint-Truiden, where the 48th bore the brunt of the attack. Ten Thunderbolts were destroyed and 31 damaged. At Asch, only one 366th P-47 was damaged.

Thunderbolt pilots from the 50th, 358th, 366th and 373rd FGs claimed 32 enemy aircraft destroyed by the end of the day. Overall, the Luftwaffe lost nearly a third of its striking force, or 280 aircraft destroyed, for absolutely no strategic or tactical gain. Had *Bodenplatte* happened in conjunction with the initial Ardennes offensive, it may have had some effect on the overall campaign. However, three weeks after the fact, when the advance had been stopped cold and the Allied counterattack was well underway, the "great blow" that *General der Jagdflieger* Adolf Galland had envisioned had proved to be a dismal failure.

The pre-Bulge lines were fully restored by January 24, and the Allied armies continued to push eastward into Germany. Operation *Grenade*, scheduled to commence on February 8, was the next major ground offensive by the 9th Army, which intended to cross the Ruhr river and encircle German forces still retreating from the Bulge. However, the offensive was delayed due to the Wehrmacht opening the floodgates of the Rur and Urft dams, thereby preventing the Ninth Army from crossing the river until February 23. XXIX TAC, tasked with supporting the 9th Army during the *Grenade* offensive, struggled to generate many sorties during February due to the onset of a sustained period of poor weather over the front. Yet despite limited air cover and delays crossing the Ruhr, *Grenade* ended on March 10 with the 9th Army capturing nearly 30,000 German troops and the Rhine river within reach.

A pair of Wirbelwinds knocked out by strafing passes from Ninth Air Force Thunderbolts during the Wehrmacht offensive in the Ardennes in December 1944. (USAAF)

Farther south, the 3rd Army had breached the Siegfried Line – known as the *Westwall* to the Germans – by February 25, and with the 4th Armored Division as its spearhead, reached a favorable crossing site at the confluence of the Rhine and Mosel rivers. However, Maj Gen Omar Bradley, Patton's superior at 12th Army Group, ordered a halt to the advance on the 26th, citing that the main effort to cross the Rhine was farther north

with Field Marshal Bernard Montgomery's 21st Army Group. Patton was told to stop advancing, much to his chagrin. Fortunately, Bradley rescinded his order, and within days the 3rd Army had captured Trier and by March 3 it was at the banks of the Mosel, ready to strike across the Rhine.

To the north, the 1st Army reached Remagen, situated right on the Rhine, on March 7. Prisoners captured the previous day by the 9th Armored Division relayed that the Ludendorff Bridge was still standing, and that it was to be destroyed at 1500 hrs on the 8th. An armored task force from the 9th Army succeeded in capturing the bridge before its destruction, securing it with infantry in the early evening and then sending tanks across under cover of darkness.

The Henschel Hs 297 Fohn Flakrakete was intended to fire 30 7.3cm unguided rockets in a barrage for enemy fighter-bombers to fly through. Although fielded at the Remagen bridgehead for the first time in early March 1945, it failed to down a single aircraft. (NARA)

The Remagen bridgehead was the first American toehold on the eastern shore of the Rhine, and it soon became the focus for both American and German air and antiaircraft forces. Remagen would be the focal point for roughly the next week, with the Luftwaffe mustering every possible aircraft in an attempt to bomb the bridge. It was quickly ringed with the highest concentration of US antiaircraft firepower of the entire war, and American AAA gunners exacted a heavy toll on attacking German aircraft.

Conversely, Remagen also saw the introduction of a new Luftwaffe antiaircraft weapon in the form of the Henschel Hs 297 "Fohn" ("hair dryer") 7.3cm Flakrakete (flak rocket) system. Twenty-four launchers had been emplaced around the town of Erpel across the river from Remagen, and they were manned by soldiers from 3./*FlakLehruVersAbt* 900 (3rd Company, Anti-Aircraft Training and Testing Battalion 900). The new weapon fired a barrage of unguided high-explosive rockets into the path of an oncoming fighter-bomber, and it was tested operationally for the first time on March 3. No hits were achieved, however.

During late March, with the additional Rhine crossing operations including the airborne assault codenamed *Varsity*, Thunderbolts were constantly overhead as the Allies advanced eastward. However, they were now ranging further from their airfields on a daily basis, which meant it was time to move again. The Ninth Air Force's P-47s groups duly relocated their ground echelons in Germany itself. Indeed, as the Allied armies rolled deeper into the Third Reich, all four TACs began to occupy airfields that had only recently been abandoned by the Luftwaffe. In full retreat on all fronts, and with Allied air power operating from airfields within the Fatherland, the outcome was obvious. Germany's surrender was now inevitable.

THE COMBATANTS

TRIGGER PULLERS

A flak battalion, or *Flakabteilung*, was roughly similar in size to a USAAF fighter group in respect to personnel, with both units being manned by just under 1,000 men. However, there were significant differences between the two organizations, and how they engaged the enemy.

A standard Luftwaffe light flak *batterie* (battery), whether fixed, mobile or armored, was built around five platoons of three 2cm guns each, allowing one *batterie* to cover a substantial area. Medium flak *batterien* had three platoons of three guns each. A Luftwaffe *Flakabteilung* would include three *batterien*, two heavy and one light. Army *Heeresflak* motorized *Flakabteilung* were slightly larger in size, being equipped with 18 2cm or nine 3.7cm guns, eight 8.8cm heavy antiaircraft guns and four 60cm searchlights. Some of the most motorized units in the Wehrmacht, the *Flakabteilung* often fought in the ground support role, as well as providing air defense for the division to which it was assigned.

The *Heer* light *Batterie* had one more platoon, or *Zug*, than its Luftwaffe counterpart, with six *Zug* in total each equipped with three 2cm guns. Within each light *Batterie*, each gun had eight to ten men on its crew, working as a team to emplace, acquire, track, sight, engage and reload in order to keep the weapon in action against an enemy aircraft.

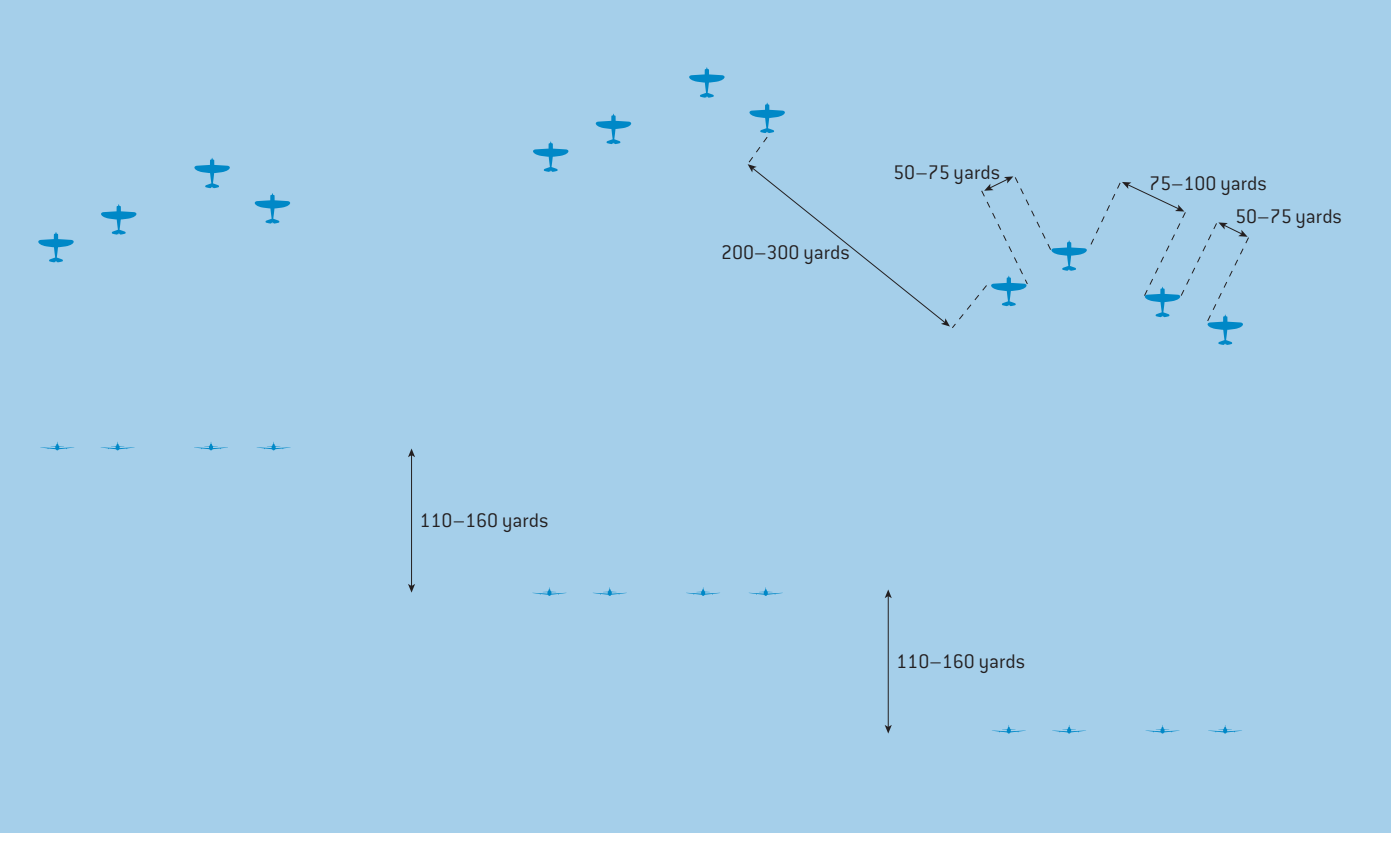
By comparison, a USAAF fighter group had significantly more destructive power. Each group had between 100 and 120 aircraft divided into three squadrons and a headquarters flight. Although arguably a more complex weapon system than the light flak guns, the P-47 was ultimately operated in combat by a crew of one.

The FlaK 36 3.7cm gun was a critical component of medium altitude air defense for Germany during the first few years of the war. Never fully replaced by the more advanced FlaK 43, the FlaK 36 performed adequately throughout the entirety of the conflict. (Author's Collection)

In combat, the smallest tactical formation fielded by a Thunderbolt squadron was a flight of four aircraft. A flight consisted of two elements of two aircraft, and usually the combat load would be standardized across the flight. A typical bombload for a fighter-bomber would be a pair of 500lb AN/M64 GP bombs underwing and an M81 260lb fragmentation bomb on the centerline.

With such a bombload, the Thunderbolt pilot had far greater firepower literally at his fingertips than the flak gunner. A 0.50-cal. projectile weighed roughly 43 grams, while the FlaK 38's 20x138mmB round was more than twice as heavy at 105 grams. The 2cm round was also larger in size and had a higher muzzle velocity than the 0.50-cal. projectile, and it also had 6.6 grams of high explosive filler. However, with a realistic rate of fire of only 180 rounds per minute per gun (nine magazine changes per gun were required to achieve this figure), the faster-firing AN/M2 with the larger ammunition capacity had the advantage in weight of fire. The 0.50-cal. fired 750-850 rounds per minute, and the P-47 carried eight such weapons, each with 425 rounds per gun. A five-second burst from all eight guns would put 500 rounds of M2 ball, M8 armor-piercing incendiary and M10 tracer into a 3ft x 3ft target area 1,100ft in front of the aircraft.

While the Thunderbolt had the advantage in weight of fire against the FlaK 38 and Flakvierling 38, the antiaircraft weapons had an advantage in range and muzzle velocity, and also enjoyed the element of surprise. *Heer* and Luftwaffe mechanized flak units were more flexible in their responses to Allied aircraft than their towed counterparts, and this proved particularly useful when the Thunderbolts were constantly on the prowl over the battlefield. Once spotted by fighter-bombers, mobile flak batteries relied on the ability to maneuver to ensure their survival against the



The standard 12-aircraft formation for Ninth Air Force fighter-bombers consisted of three flights, each flying in "finger-four" formation. Finger-four was arranged as the tips of the fingers on an outstretched hand, with the flight lead as the middle finger, his wingman as the index finger, the second element leader as the ring finger, and his wingman as the pinkie. The two elements in the flight worked together, allowing the greatest flexibility in most combat situations. The flight leader's element would locate and initiate the attack on the intended target, while the second element provided cover for his tail.

The squadron formation used either three or four four-ship flights and staggered them in both altitude and horizontal separation to most effectively protect one another from air attack. The flights would maintain 200-300 yards horizontal and 110-160 yards vertical separation between them en route to the target. Once the target was sighted, often the attack would be conducted by flights in order from low flight to high flight. When the lowest flight dropped its bombs and completed its strafing, it would climb to altitude and provide top cover for the subsequent attacking flights.

Jabos, and the more mechanized a flak unit was, the better its chances of survival. Towed flak units caught on roads during daylight hours would have to stop and dismount their guns from prime movers and emplace before engaging, leaving crews and vehicles exposed while the guns were put into action. Self-propelled flak, however, was able to maneuver and fire simultaneously.

Although mobility was key to the survival of mechanized flak units during 1944–45, fixed sites were more than capable of effectively defending themselves from aerial attack. Indeed, concealed flak positions surrounding enemy airfields inflicted more casualties on fighter-bombers. These would often lay in wait for the unsuspecting Thunderbolt unit to pounce on a lone aircraft conspicuously placed on an airfield, as detailed in the following extract from a combat report:

Groundcrew from the 56th FG use a purpose-built loading dolley during the attachment of a 500lb AN/M64 GP bomb to the starboard wing pylon of a P-47D in the summer of 1944. This weapon, and the aircraft's eight 0.50-cal. machine guns, provided the Thunderbolt pilot with formidable firepower. (NARA)

> Twelve P-47s were on an armed reconnaissance when the leader spotted an enemy airfield on which was parked an Me 110. The Squadron Commander ordered an attack by flights. The 110 was destroyed by fire, but on this mission, we lost four P-47s from an unexpected amount of ground fire.

Flak units had prepositioned a mortally damaged Bf 110 specifically to attract the attention of a roaming Thunderbolt flight, and pre-sighted their guns to cover all potential avenues of approach. The urge to destroy enemy aircraft was often a driving factor that sometimes overrode sound tactical decision making.

This USAAF training poster was intended to humorously convey the threat posed by medium-range antiaircraft guns like the 40mm Bofors. As graphically shown in this stylized artwork, a single hit from such a weapon could destroy a P-47. (US Army Air Defense Artillery Museum)

THE MAINTAINERS

For a fighter group to achieve its full potential in a punishing combat environment, its aircraft required effective maintenance. Pilots were reliant on their groundcrews to maintain, repair and arm their aircraft. The basic crew for each Thunderbolt consisted of a crew chief, assistant crew chief and an armorer who were directly responsible for the day-to-day upkeep of the aircraft and the monitoring of its major maintenance requirements. They provided first level maintenance for the fighter in much the same way as a flak crew would for its assigned gun. However, P-47 groundcrews would routinely work together to maintain all aircraft within the squadron when necessary, and the unit's ground personnel striving to achieve the highest operational readiness rates whenever possible.

Groundcrews routinely worked miracles keeping Thunderbolts airworthy after sustaining severe combat damage. If a pilot was able to bring a damaged fighter-bomber back to base, maintenance personnel could usually get the aircraft airworthy again, and if not, serviceable components would be stripped and saved for other airframes. Engine changes and entire wing replacements were often completed by the lowest level maintenance echelon under the most primitive of conditions.

In the event of a Thunderbolt going down, a replacement aircraft and pilot were duly requested. It would take a few days for a new fighter to arrive on the continent from England, but new, well-trained pilots were constantly flowing in from the training pipeline in America across the Atlantic to Britain and then on to frontline units. Of course, replacing a combat-experienced aviator was another matter, but new arrivals were quickly oriented to the perils of low-level fighter-bomber work, where they would fly on the wing of a more experienced pilot until they had proven themselves.

Flak crews were also responsible for the first line maintenance of their vehicles and weapon systems. However, unlike the Thunderbolt groundcrew, the lives of the flak crew directly depended on their vehicle and weapon functioning properly in combat. All routine and preventive maintenance was conducted by the vehicle and gun crew, but if higher-level repairs were required, each *Flakabteilung* had a motor maintenance detachment that was responsible for such work within the battalion. In addition, there was also

Nineteen-year-old 2Lt Edwin "Lucky" Wright of the 506th FS/404th FG returned from his 39th mission (to Münster, in Germany) in late October 1944 to discover an eight-inch diameter hole caused by a direct flak hit through his eleven-inch diameter propeller blade. He knew his Thunderbolt had been struck by enemy fire, but continued on his mission, dropping his bombs and "doing a spot of strafing" before returning to Sint-Truiden (A-92). This was the sixth time that Wright had been hit by flak, hence his nickname. His luck held through to the end of his tour, by which point he had flown 88 missions. (NARA)

A Thunderbolt of the 389th FS/366th FG is serviced and rearmed under the summer sun at Saint-Pierre-du-Mont (A-1) shortly after flying in to Normandy from southern England on June 17, 1944. Six days earlier, the 366th had attacked the 130th Panzer Division when it attempted a counterattack against the Normandy beachhead under the cover of a heavy overcast. Although the cloud base was down to 1,000ft, the P-47 pilots succeeded in knocking out 22 tanks. (NARA)

an ordnance detachment that was tasked with conducting higher-level maintenance and repair for the mounted antiaircraft systems.

In the early campaigns, German motor and ordnance maintenance units generally lacked for nothing. Minor repairs could be handled easily at battalion level, and major rebuilds or significant repairs were sent back to depots in Germany. However, in 1943, the Armaments Ministry shifted priorities and began ramping up production numbers for complete vehicles and weapon systems, at the expense of spare parts. One Panzer commander wrote that, "While pressing for an increase in the production of new tanks [and armored vehicles], they had neglected the urgent need for spare parts until it was too late and irreparable damage had been done. With its limited industrial capacity, Germany was unable to produce more new tanks and a satisfactory amount of spare parts at the same time. The armored forces therefore suffered from a constant shortage of tank spare parts until the end of the war."

Flak units were issued vehicle types as they became available, and therefore standardization was difficult. With no fewer than four major flak halftrack types (Sd.Kfz. 7, 10, 11 and 251) and at least six different weapon systems, maintaining a spare parts inventory was a major challenge to repair crews. Because of the effectiveness of the battlefield interdiction missions flown by Thunderbolt groups across Europe, already scarce spare parts were even harder to obtain. Moving spare parts to units on the front required rail and truck transportation – high-priority targets for marauding Thunderbolt pilots flying armed reconnaissance missions. It was often easier for flak crews to get a completely new vehicle that had been driven at night up to the front than it was to acquire the necessary spares to get an inoperable vehicle or flak gun functional again.

THE COMMANDERS

Leadership was crucial to mission success, and the examples set by commanding officers at the top set the standard for units in the field. The flak and Thunderbolt commanders on the Western Front were professional officers with a great deal of operational experience. The Ninth Air Force's IX TAC was led by Maj Gen Elwood "Pete" Quesada, and his fighter-bombers were opposed by flak batteries commanded by Generalleutnant Wolfgang Pickert, who had served on the Eastern Front until May 1944 when he relinquished command of the 9th Flak Division.

While flak commanders were required to coordinate multiple weapons to engage enemy aircraft, fighter squadron and group leaders were coordinating avenues of approach, attack altitudes and counter-flak plans. The mission commander (usually a squadron or group commander, but not always) would lead the formation, and his subordinate pilots would follow in the attack.

The flak commander directed his flak vehicles by radio and verbal order to maneuver into the best positions to engage incoming aircraft targeting friendly ground forces, or to lay in wait around a tempting target for the *Jabos* and then spring the flak trap. He would interact directly with his junior officers, NCOs and crews to ensure adequate ammunition was on hand, crews were operating efficiently and vehicles were maintained. By comparison, the fighter group commander, at least during a combat mission, had to deal with flying and fighting his own aircraft, keeping track of the rest of his formation via radio and visual confirmation and also having to rely on the other pilots to follow him to the target.

Both *Flakabteilung* and fighter groups were led by experienced commanders who had earned their positions through the test of combat. Less than remarkable commanders were quickly replaced, whether through relief or combat loss. Capable leadership, coupled with a capable combat platform and effective and flexible doctrine, would be the key to victory. In the ETO, Allied tactical air power had a decisive edge in both platform and doctrine. Thunderbolt units were quick to adapt, develop new tactics and improve their aircraft so as to be more survivable against ever present flak units, as well as be more combat effective.

Col Ray Stecker, CO of the 365th FG from June 26, 1944 through to April 27, 1945, asks SSgt Harry Greenwood if his Thunderbolt is repairable after he returned to the group's Juvincourt-et-Damary (A-68) base following a particularly well opposed attack. Unsurprisingly, the P-47 was classified as fit for salvage only. According to Stecker's wingman, 1Lt Tom Manjak, his CO "lead from the front and was a balls-out high-speed individual. He flew low, fast and bored in with his bombs. If Stecker returned with one round of ammo and was running on more than fumes, he was having an off day." (NARA)

WOLFGANG PICKERT

Wolfgang Pickert was born in Posen on February 3, 1897. On August 2, 1914, aged 17, he volunteered to serve in the Royal Prussian Army. Pickert was assigned to *Feldartillerie Regiment* 73, with whom he served in combat as an artilleryman on the Eastern Front until early January 1916 when he was posted to the Field Artillery school as an officer candidate. Pickert was commissioned a Leutnant der Reserve on October 7, 1916 and assigned to *Feldartillerie Regiment* 93. Seeing much action with the unit over the next 18 months, Pickert had earned both the Iron Cross 1st and 2nd Classes and the Wound Badge in black by war's end.

Pickert was one of the very few officers to remain in the military after the cessation of hostilities and the signing of the Treaty of Versailles. With the newly reconstituted Reichswehr being limited to 100,000 men, only the best officers were retained. Pickert served in the 1st Prussian Artillery Regiment during the majority of his time in the Reichswehr, eventually commanding the 6th *Batterie* after his promotion to hauptmann on February 1, 1931. He remained in *Batterie* command through to September 1934 as the National Socialists rose to power.

General der Flakwaffe Wolfgang Pickert. (EN Archive)

As the Nazis consolidated their hold on the country and began to rebuild the Reichswehr into the Wehrmacht, Pickert was posted to the flak artillery school as an instructor and was accepted as a Luftwaffe officer. With German rearmament in high gear, Pickert was selected to be an armaments inspector for the *Flakwaffe*, since he had been trained in ordnance, artillery and antiaircraft tactics. He remained in that role for nearly two years before being given command of I./*Flakregiment* 49 in 1937 and subsequent promotion to oberstleutnant.

As war loomed, Pickert began a period of service in a number of key staff roles throughout the *Flakwaffe*. Finally, in June 1942, he assumed command of 9.*Flakdivision*, which he would lead during the Stalingrad campaign. He was awarded the Knight's Cross for his command of the division during the Don breakthrough. However, in January 1943, the division was lost along with the rest of 6th Army when it was encircled by Soviet forces. Pickert had been flown out of Stalingrad to personally brief Hitler on the conditions there just days before 6th Army surrendered, thus avoiding capture. 9.*Flakdivision* was reconstituted in the Crimea in the summer of 1943, where it fought until it was again destroyed in May 1944. For his leadership during the Crimean and Kuban campaigns, Pickert was awarded the Oak Leaves to the Knight's Cross on June 5, 1944. By that time, he had already been in France for a month, having assumed command of III. *Flakkorps* in early May.

Pickert's leadership would get III. *Flakkorps* through its near destruction in the Falaise Pocket, allowing it to be reconstituted in Germany. Here, it would refit and retrain in order to participate in the Battle of the Bulge and the withdrawal of the Wehrmacht into Germany. Pickert led III.*Flakkorps* until March 25, 1945, when he was reassigned to the *Oberkommando der Luftwaffe* as the *General der Flakwaffe* – a position he held until Germany surrendered on May 8, 1945, when he was captured by American forces. Remaining in Allied custody until January 1948, Wolfgang Pickert passed away on July 19, 1984.

ELWOOD R. "PETE" QUESADA

Elwood "Pete" Quesada was born in Washington, D.C. on April 13, 1904 to an Irish-American mother and Spanish father. He enlisted in the USAAC as a flying cadet in 1924 and was commissioned as a reserve officer the following year. His first assignment following two years of inactivity was as an engineering officer at Bolling Field in Washington, D.C., where he served for just nine months before being selected to be aide de camp for Maj Gen James Fechet, Chief of the USAAC. He held this position for two years.

During the first week of January 1929, 1Lt Quesada served as a relief pilot in a modified USAAC Atlantic-Fokker C-2A as its crew attempted to prove that aerial refueling was possible and long endurance flights could be performed. The aircraft remained aloft for more than 150 hours, refueling 37 times. The crew, led by Maj Carl Spaatz, included Capt Ira Eaker, 1Lts Harry Halverson and Quesada and Sgt Roy Hooe, who served as the refueler. All five were awarded the Distinguished Flying Cross after completing their mission, and proving the concept of aerial refueling.

After several high-profile aide and liaison assignments in both the US and Latin America, and attending Command and General Staff College, Quesada was made commanding officer of the 33rd Pursuit Group at Mitchel Field, New York.

Maj Gen "Pete" Quesada (right) helps 368th FG CO Col Frank Perego refuel his Thunderbolt. (USAAF)

He was serving in this role when Pearl Harbor was attacked on December 7, 1941.

Quesada spent the first year of the war commanding the Philadelphia sector of I Fighter Command, being promoted to lieutenant general in December 1942 when he assumed overall command of the 1st Air Defense Wing and returned to Mitchel Field. Just a month later, in January 1943, Quesada and his command departed New York for North Africa, where the 1st Air Defense Wing would be integrated with the North African Coastal Air Force (NACAF). Quesada was made second in command of the NACAF and concurrently assumed command of XII Fighter Command. He flew combat missions in North Africa, Sicily and Italy, often preferring to be in the cockpit of a fighter over the front than behind a desk.

Having observed the invasions of Sicily and Salerno from the cockpit of his personal P-38 Lightning, Quesada found himself in England by October 1943 helping to plan the tactical air umbrella over the cross-channel invasion of France and assuming command of IX Fighter Command, which shortly thereafter became IX TAC. By the eve of the Normandy invasion, his headquarters had drawn up the majority of the plans for the effective employment of tactical air support for Operation *Overlord*.

Knowing they had begun experimenting with the P-47 in the fighter-bomber role in Italy, Maj Gen Quesada contacted Twelfth Air Force commander Maj Gen John Cannon for advice on how best to train up his Thunderbolt pilots prior to the invasion. In the spring of 1944, Quesada and Cannon worked out an exchange program whereby Twelfth Air Force P-47 pilots came to England to train up Ninth Air Force P-47 pilots on dive-bombing techniques. Simultaneously, Ninth Air Force pilots were sent to Italy for "on the job training" with one of the two fighter groups flying Thunderbolts.

Quesada's understanding of the requirements of tactical air power as they pertained to the situation on the ground was unmatched. Almost instinctively, he knew what was needed for IX TAC to be able to accomplish its mission of shaping the battlefield, and he made sure his pilots had the necessary tools to accomplish the task. Quesada would remain as commander of IX TAC through to VE Day, finally returning to the US in June 1945. Retiring from the US Air Force in 1951, he became heavily involved in civil aviation at a federal level. Elwood "Pete" Quesada died on February 9, 1993.

COMBAT

"The road to Bastogne had been worked over by Ninth Air Force Thunderbolts before the Third Army tanks (under Patton) finally cleared the way. A colleague and I drove up to Bastogne on a secondary road through breathtaking scenery. The Thunderbolts had created this scenery. You can say the words 'death and destruction' and they don't mean anything. But they are awful words when you are looking at what they mean.

"There were some German staff cars along the side of the road. They had not merely been hit by machine gun bullets; they had been mashed into the ground. There were halftracks and tanks literally wrenched apart, and a gun position hit directly by bombs. All around these lacerated or flattened objects of steel there was the usual riffraff: papers, tin cans, cartridge belts, helmets, an odd shoe, clothing. There were, also, ignored and completely inhuman, the hard, frozen corpses of Germans.

"We had watched the Thunderbolts working for several days. They flew in small packs and streaked into the attacks in single file. They passed quickly through the sky, and when they dived, you held your breath and waited: it seemed impossible that the plane would be able to pull itself up to safety. They were diving to within 60ft of the ground.

"The snub-nosed Thunderbolt is more feared by the Germans than any other plane."

Although written several months after the Ninth and Twelfth Air Forces began flying close air support and battlefield interdiction missions in support of the Allied advance on the ground, the words of legendary journalist Martha Gellhorn echoed scenes across France, Belgium and Germany from early 1944 through to May 1945.

The build-up to the invasion in the early months of 1944 opened a new phase of the air war. Eighth and Ninth Air Force Thunderbolts were now able to range over northern France and strike targets of opportunity as they saw fit while conducting

armed reconnaissance or fighter sweep missions. If it moved and had a cross on it, it was a target. Conversely, it was during this time that Ninth Air Force P-47 units began standardizing visual identification markings by adding a second national insignia under the left wing to make positive identification easy for friendly antiaircraft gunners. Unfortunately, it also made it a great deal easier for German flak gunners to quickly identify targets.

Armed reconnaissance sorties were always dangerous affairs, and it was not uncommon for a squadron to lose one or more aircraft on a single mission. A squadron losing two single-seat fighters was nowhere near as consequential as losing two bombers with 20 men aboard, but it still hit Thunderbolt units hard. April 9, 1944 was one such day for the 366th FG's 389th FS. Sent on an armed reconnaissance mission south of Caen, its two flights of four aircraft attacked the marshaling yards at Argentan and Mezidon, in France. "White" Flight, led by Capt Warren Vinzant, strafed the yard at Mezidon with minimal opposition, hitting several locomotives and rolling stock. As the flight pulled off, the flak guns opened up. Lt Charles Benjamin was leading the second element in Capt Vinzant's flight:

> As we approached the target, the area was free of flak, but after diving and strafing and as we pulled away across the field to the southwest, Lt Ozier slid from his normal position to a place between Lt Cope and myself. At that time, my altitude was about 150ft and Cope and Crozier were at about 300ft. Suddenly, a large concentration of intense light flak appeared in front of and around us. Lt Ozier was seen to climb gradually and then roll over onto his back. Still inverted, his plane gained altitude until at about 800ft, where he fell from the ship. The parachute opened immediately, and I saw Lt Ozier reach the ground and his chute collapse.

From Benjamin's narrative, it seems that his flight made a fatal mistake. They dove and strafed but did not use the built-up speed from their attack to climb back up to a safe altitude out of the range of flak and small arms. They also straightened out at between 150–300ft, making themselves large, slow targets for German flak gunners. James Ozier survived the bailout and was captured very quickly, spending the remainder of the war in a PoW camp.

Several miles south, over Argentan, another flight from the same squadron had a similar encounter. However, Capt Kirby Martin's "Red" Flight climbed back to 3,000ft after making their strafing passes:

> When pulling away from the railroad yards, I felt an explosion that rocked my ship. Lt Forbes, the second element leader in Red flight, after crossing the target, started climbing straight ahead. When called to return to the flight, he said he was hit. Lt Forbes said his oil pressure had dropped to zero, but he would stay with the ship and try to make the Channel. His next call stated that his engine was freezing due to a lack of oil, and that he was at 2,000ft and was bailing out.

Forbes too was captured, and repatriated in April 1945. It is unclear exactly when he was hit, but Forbes' strafing run illustrates the most dangerous moment in the attack – focused on the target and flying on a constant angle at a relatively constant

airspeed. Evasive action while putting rounds, bombs or rockets on target would lessen accuracy. Once weapons were released, or the pilot ceased firing, his best chance to escape unscathed was to "pour on the coals" (increase speed) and change directions along two axes (climb and turn). That forced the flak gunner to attempt to track in three dimensions, having to simultaneously traverse, elevate and compensate for a change in speed.

The gunner on all the German flak weapons was in control of traverse, elevation and firing. His left hand controlled traverse, right elevation and his foot fired the trigger. The sighting system was linked to elevation, and it would be collimated with the gun tube for accuracy. A gunner engaging a target diving at 400mph was working very hard to properly track, lead and fire with accuracy.

In the pre-dawn hours of June 6, 1944, 16 Thunderbolt-equipped fighter groups from the Eighth and Ninth Air Forces stood ready to launch in support of the invasion. They would duly put in a "maximum effort" in order to stop German reinforcements from reaching the beachhead. The 404th FG set a group-wide record of 191 sorties in a single day, although both enemy flak and fighters were absent in their operational sector. The unit history recalls, "But no enemy reaction; meager flak north of St. Lo once, on the second morning mission June 6, but otherwise 'nil' for flak. Most repeated comment was, 'Where the hell is the Luftwaffe?'"

Only nine Thunderbolts were lost on D-Day to all causes. Of those, three were downed by flak, three were caught by their own bomb blasts and the remaining three were due to unknown reasons. Nine losses for more than 2,200 sorties flown was an impressive milestone for IX TAC. The sun set on June 6 with the Allies firmly ashore and consolidating the beachhead and IX TAC isolating the battlefield from potential German reinforcements.

The following day, the operations tempo increased significantly, and the enemy was determined not to make the mistakes of the previous 24 hours. The Luftwaffe made an appearance, attacking and shooting down three P-47s from the 362nd FG during the group's second mission of the day. Bombed up and vulnerable when bounced, the 362nd could claim only one Fw 190 destroyed before the action was over.

In the 366th FG's sector, each of the group's three squadrons flew four missions. Remaining over the continent for maximum endurance, they flew from Bayeux west to Isigny, before egressing northwards via Grandcamp. The first operation of the day was flown "heavy," with three 500lb GP bombs per Thunderbolt. On subsequent missions, the third bomb was swapped out for a 108-gallon centerline fuel tank or fragmentation cluster bombs.

The 5cm FlaK 41 was a German attempt at a true medium-range antiaircraft gun that would have the hitting power of a heavy gun and the automatic firing capability of a light gun. Only a handful were delivered to the Luftwaffe, roughly 20 of which saw combat on the Normandy front before they were withdrawn from service. (US Army via Steve Zaloga)

P-47D-20-RE 42-76452 was assigned to the 371st FG's 405th FS in the spring of 1944, and it saw considerable action in support of Operation *Overlord*. The aircraft carried the name of 1Lt Arthur W. "Bud" Holderness beneath the cockpit, and he flew a good number of his 142 combat missions in the fighter-bomber. Seen here with 41 mission symbols and single AN/M64 500lb GP bombs beneath each wing, *"MUMBLIN JOE"* was photographed at Beuzeville-la-Bastille (A-6), in France, in August 1944. (USAAF)

According to the mission brief, "gun positions will be given priority, as they have taken a heavy toll on Beach Omaha." The first squadron took off at 0600 hrs, followed every 90 minutes by successive squadrons until 2230 hrs.

The 366th FG's 390th FS would fly four missions during the course of the day, losing Lt Henry Hyde due to unknown causes on the first operation. For the unit's final mission on June 7, the nine-ship formation was bombed up with 36 M41 20lb fragmentation bombs, each on a 12-round cluster adapter. The "frags" were used sparingly throughout the course of the mission, with "Hoover Blue" Flight having already hit several targets when they came across German Panzers. Flight leader Capt Mack Stroehm subsequently recalled:

> We spotted approximately 12 tanks on the road south of Vire. Lt Luthy was flying Hoover Blue 2 and had not dropped his bombs. I told him to climb to 4,000ft and make a bombing run. I followed him down and saw a bomb explode directly under him as he released his own bombs. He dropped one bomb, but the other did not release. Pulling off the target, he was trailing black smoke. He reported his engine was running rough. Climbing to 4,000ft and heading 340, he leveled off, at which point his engine quit and he bailed out. I saw his chute open immediately but did not see him land.

Lt Paul Luthy would be the only survivor (albeit as a PoW) of the four pilots from the 366th FG shot down on June 7 – the bloodiest day in the group's history. In all, IX TAC flew nearly 2,800 sorties on the 7th for the loss of 20 Thunderbolts. The Eighth Air Force's P-47-equipped 56th, 78th and 353rd FGs were also flying tactical missions in supporting of Ninth Air Force operations that day, and they lost a further ten Thunderbolts between them. Of the 30 aircraft destroyed, half were brought down by light, intense and accurate flak.

FALAISE

As the Allies pushed south from the beachhead and began expanding the front, tactical air power would play a key role in cutting off the enemy's avenue of escape. After weeks of bitter fighting in the Norman hedgerows, Operation *Cobra* – the tactical use of strategic bombers to assist the breakout from Normandy – proved successful in the last week of July. From there, the 3rd Army headed west toward Avranches and Dinard, with XIX TAC providing air cover, while the 1st Army advanced south toward Paris with IX TAC overhead.

As the Allied armies broke out of Normandy, the Wehrmacht's Army Group B was forced to retreat or be cut off. Although III. *Flakkorps'* three *Flaksturm* regiments had been badly depleted in the fighting immediately after D-Day, they were now tasked with providing an antiaircraft umbrella over a far larger organization than they were accustomed to. Individual *Heeresflak Abteilung* were overextended as well attempting to provide direct fire support against ground forces for an Army Group in retreat, while also trying to ration ammunition in order to deal with the more significant and constant threat of air attack.

By August 18, more than 100,000 German troops were nearly surrounded. That morning, the 36th FG launched 35 aircraft – each one armed with a pair of 250lb GP bombs – from Brucheville (A-16) at 0800 hrs. Shortly thereafter, approximately 1,000 to 1,500 enemy motor transports were sighted on roads bumper to bumper on three sides of Argentan. Some were parked, others were moving northwest from the town. Vehicles of all types were duly bombed and strafed throughout the area, with dozens destroyed and damaged.

The 36th FG's 22nd FS was diverted from its original assigned target in order to join the fray, dive-bombing and strafing targets of opportunity in the Falaise–Argentan area. Light, intense and accurate flak was encountered throughout the mission. Capt Cyril Browne dive-bombed and strafed a number of vehicles, claiming ten trucks destroyed before flak hit both him and the engine of his Thunderbolt. Browne stayed with his stricken fighter, P-47D-27-RE 42-27217, until the propeller separated from the engine, forcing him to bail out. He was quickly picked up by friendly forces and transported to a US Army field hospital, where his wounds were tended to. For his actions in attempting to save his aircraft, Browne was awarded the Distinguished Flying Cross. Soon back in the cockpit, he flew missions into the new year. On February 8, 1945, Browne volunteered for one final operation prior to rotating home. He did not return from the mission.

The Allied armies finally closed the Falaise Pocket on August 21, trapping roughly 60,000 Germans. About the same number had escaped before the noose tightened completely. By then, III. *Flakkorps*

Capt Edwin O. Fisher of the 377th FS/362nd FG poses atop his P-47D-27-RE 42-26919 *Shirley Jane III* at Lignerolles (A-12), in France, in August 1944. He was one of three aces in this group, being credited with seven German fighters shot down. Fisher, who also destroyed three V1 flying bombs, had his groundcrew meticulously record his strafing sorties against road transport and trains, with shallow dive-bombing and fighter sweeps all listed separately. 42-26919 fell to flak near Metz, in France, on October 26, 1944. (NARA)

OPPOSITE
F-6B Mustangs of the 107th Tactical Reconnaissance Squadron flew multiple missions over the increasingly cratered Ile de Cézembre during August 1944, photographing gun and flak positions with every pass. The three large hexagonal emplacements seen in this vertical image were for the coastal artillery guns that were used to control the approaches to the port of Saint-Malo. The smaller emplacements around them housed 2cm flak weapons of both Oerlikon and Mauser types. (Author's Collection)

had taken significant casualties and lost much of its equipment. Despite this, the unit was able to reform in eastern France and continue fighting. It was eventually pulled back into Germany, where its three *Flaksturm* regiments outfitted with new equipment and personnel and commenced training for the next big offensive.

MARINEFLAK – COASTAL DEFENSE

The first flak units that Ninth Air Force P-47s encountered as they crossed the coast at low level once fighter groups commenced *Jabo* operations in February 1944 were the *Marineflak* battalions charged with defending "Fortress Europe." These were static units that operated from semi-permanent positions, usually made from reinforced concrete, to provide cover for the gun crews. Quite often, the *Marineflak* battalions had conscripts from Russia or other Axis nations supporting the gun crews.

Because of their static nature, and the fact that most priority targets were further inland, Thunderbolt units often avoided the coastal flak units simply by flying higher than the guns could reach, before descending to lower altitudes as they neared the target area. However, as the Allied armies pushed inland and the 3rd Army split off and advanced into Brittany, coastal defenses again became a concern. The Allies needed ports through which all the supplies required to sustain the war effort had to flow. Saint-Malo was one of the first port facilities captured after Brest, but in order for it to be opened to Allied shipping, 1. *Batterie* of *Marineartillerie Abteilung* 608 stationed on the Ile de Cézembre, just off the coast, had to first be neutralized.

Fixed flak defenses were usually found defending high-value targets like airfields, marshaling yards, ammunition dumps, bridges and coastlines. Guns were semi-permanently emplaced to afford the best cover and the best interlocking fields of fire along the most likely avenues of approach. Each emplacement included the main gun pit, and a smaller pit a few meters away for the rangefinder – usually an EM.R.36 1-meter focal length type. The rangefinder, coupled with the weapon's sights, would give flak gunners the clear data needed to engage enemy aircraft.

While use of the 4cm FlaK 28 Bofors gun was uncommon within Wehrmacht and Luftwaffe units, the Kriegsmarine had a number of them that it used in the coastal defense antiaircraft role along the French coast. (Author's Collection)

The Ile de Cézembre's flak defenses were impressive for a relatively small rock less than a kilometer long – 13 antiaircraft guns, ranging from 2cm to 7.5cm in size. These were to protect the island's seven heavy artillery pieces that when interlocked with similar weapons on the island of Guernsey completely controlled the nautical approach to Saint-Malo. Two of the 2cm guns were Kriegsmarine 2cm FlaK 29s on navy-style pedestal mounts. This weapon was based on the Oerlikon 20mm cannon, and it was essentially the same as the gun widely used by the US Navy and Royal Navy. In addition to the two Oerlikons, there

were also three quad-mount Flakvierling 38s in concrete emplacements. Two slightly larger 4cm FlaK 28 Bofors extended the flak umbrella, and six captured French 7.5cm Modele 32 guns that could reach up to 27,000ft completed the layered defenses. Air attack to neutralize the coastal guns would be difficult.

From August 13, the USAAF began one of the most intensely concentrated bombardments of the entire war. For three weeks straight the Ile de Cézembre was under almost constant bombardment by strategic and tactical aircraft, as well as naval gunfire from two British battleships. The *Batterie* commander, Oberleutnant Richard Seuss, was awarded the Knight's Cross on August 15 for commanding the island's defenses and holding out despite terrible odds. Over the next several weeks, Thunderbolts strafed and dropped napalm, white phosphorous and GP bombs as they provided key flak suppression while B-24s pummeled the island. The flak defenses were formidable, but largely ineffective, with Allied aircraft, including repeated P-47 strikes from several Thunderbolt groups, being able to bomb the island with near impunity.

The newly fielded napalm firebombs took a horrible toll on men and materiel alike. The flames burned so hot that in at least one case a 7.5cm gun tube melted after taking a direct hit. Napalm was an exceptionally demoralizing weapon for flak gunners to face.

Finally, on the morning of September 2, Oberleutnant Seuss surrendered to the 83rd Infantry Division's 330th Infantry Regiment just hours before the Regiment's 2nd Battalion was to commence an amphibious assault on the island.

Napalm was used with significant effect by P-47's targeting the Ile de Cézembre in August 1944. (USAAF)

PREVIOUS PAGES
On August 23, 1944, 1Lt Donald Ross of the 406th FS/371st FG led a flight of 12 Thunderbolts against flak batteries on the Ile de Cézembre, the pilot targeting a Kriegsmarine 2cm FlaK 29 pedestal-mounted weapon with his single 500lb bomb. The 406th was specifically tasked with flak suppression on this mission, clearing the way for Eighth Air Force B-24s sent to bomb the heavy weapons of 1. *Batterie* of *Marineartillerie Abteilung* 608. Armament for the P-47s was intentionally light, with each aircraft only carrying a single 500lb bomb on the centerline and full 0.50-cal. ammunition so that the squadron could maneuver quickly once the ordnance had been released. Time on target was 1330 hrs, and just a few seconds prior, US Army artillery on the nearby Brittany shoreline fired several smoke rounds to mark the target. Ross contacted the ground controller "Ripsaw" and was cleared inbound. The squadron then broke up into three flights and followed Ross's lead flight down to hit the gun positions. Half of the squadron's bombs found their targets. The others either fell short or had no effect. The squadron followed with several strafing passes, focusing on the flak positions. The concrete emplacements did little to protect the gun crews from the torrent of 0.50-cal. fire as the Thunderbolts rolled in. Many of the gun crews sought refuge in the caves and tunnels as the P-47s dove down, rather than be exposed with minimal armor protection.

RACE TO GERMANY

As the Allied armies pushed eastward, effective coordination between air and ground forces was necessary to prevent fratricide and to ensure the best possible employment of fighter-bombers in the close air support role. By late September the 1st Army had pushed into the Netherlands, and on October 2 the 7th Armored Division was given the mission of capturing Overloon and Vortum-Mullem. Combat Command B's Task Force 2 was ordered to seize the latter town, and it had Thunderbolts from the 366th FG providing direct support as the troops advanced.

Task Force 2 met stiff resistance on the approaches to Vortum-Mullem, where the 107th Panzer Brigade and supporting elements had dug in antitank guns and pillboxes. At 1400 hrs, 1Lt William Grounds led the 389th FS's 12 Thunderbolt on an armed reconnaissance mission in support of the 7th Armored Division. Checking in with ground controller "Wetrag," 1Lt Grounds' squadron was vectored toward Vortum-Mullem to support troops coming under fire. Once in the vicinity, the squadron was passed to the local controller "Tolly," who identified the target as two large tanks, most likely Panthers, obscured by haystacks on the east side of town. Grounds split his squadron, sending "Blue" Flight, under Lt Morton Koff, to provide top cover, while the remaining two flights dropped down to attack the tanks. Koff later recalled:

> Lt Grounds led the flight to the target, which we approached from the north. He made a 270-degree arc of a circle, before peeling off to bomb from the east. I was leading Blue Flight, as top cover, so I observed everything. Lt Grounds completed his run and scored a direct hit. Then his plane seemed to execute a "vertical reverse," which ended in an inverted position. It never recovered, striking the ground in that manner while still headed in a westerly direction.

Unbeknown to the pilots of the 389th, the 107th Panzer Brigade had gained a *Heeresflak Zug* of four Flakpanzer IV Mobelwagens, armed with 3.7cm FlaK 43s, at the end of August. Analyzing photographs of the damage inflicted on 2Lt Grounds' P-47, most notably the large penetration just ahead of the empennage that obliterated the aircraft's individual call letter "G," it is likely that a catastrophic hit from one of these camouflaged Flakpanzers' 3.7cm guns severed the fighter's control cables, causing it to invert out of the pilot's control and crash.

Despite the loss of 1Lt Grounds, the 389th remained on station, destroyed both tanks and strafed a windmill that was serving as an observation post and flak tower near Vortum-Mullem, silencing it. The 7th Armored Division's Task Force 2 had taken the town by 1930 hrs on October 2. Overloon was liberated four days later.

Flak was a constant threat to Thunderbolts operating at low level. Prepared defensive positions and effective concealment were key to maintaining the element of surprise. Once a flak gun's position was revealed, it could be acquired, targeted and knocked out. But an experienced, patient crew knew to wait until the *Jabo* had committed to its attack before opening fire. At that point, the Thunderbolt pilot had two choices – disengage, and miss his target, or press home the attack and hope that the flak gunners would not be able to hit him.

The Thunderbolt of 1Lt William Grounds from the 389th FS/366th FG crashed inverted after being hit by a 3.7cm FlaK 43 round in the rear fuselage, the shell being fired from a Flakpanzer IV Mobelwagen. The GI on the right is resting his foot in the shell hole that completely obliterated the individual aircraft letter "G" on the fuselage of P-47D-28-RE 44-19728. (Author's Collection)

Air-ground cooperation would be critical in mid-December when the 5th and 6th Panzer Armies broke through American lines in the Ardennes in an attempt to reach Antwerp and force the Allies into negotiating a peace deal. The SS-*Flakabteilung* assigned to the subordinate divisions within both armies were among the best equipped in all of the Wehrmacht. The new Flakpanzer IV Wirbelwind had been prioritized for the operation, and a number of them provided antiaircraft cover as they pushed westward.

For the initial phase of the offensive, the airborne threat was limited due to low-lying fog that kept Ninth Air Force Thunderbolts mostly grounded for the first five days of the Battle of the Bulge. The 406th FG, flying from Mourmelon-le-Grand (A-80) in France, had built a strong working relationship with the 101st Airborne Division whilst it was stationed at the same airfield in order to train, refit and prepare for its next airborne drop. With the news of the breakthrough in the Ardennes, the 101st was immediately sent to Bastogne, in Belgium. According to the 406th FG's monthly history report:

> During these five days, the reports continued to come in indicating the seriousness of the situation. Ground personnel worked day and night, readying all the available aircraft, and the pilots and staff pestered the weatherman incessantly and worriedly hung around the ready rooms.

On the morning of December 23 the fog finally lifted, and the 406th began an operational pace unprecedented in the group's history. Its 513th FS was tasked with supporting VIII Corps throughout the day, flying four armed reconnaissance missions during which pilots attacked targets of opportunity as they materialized. With their aircraft carrying 500lb GP bombs, 260lb "frags" and 5in. HVARs, pilots on the first mission of the day checked in with the local ground controller, call-sign "Ripsaw," and

P-47D-28 THUNDERBOLT COCKPIT

1. Landing gear control lever
2. Elevator trim tab control wheel
3. Turbine overspeed warning light
4. Fuel level warning light
5. Rudder trim tab control
6. Aileron trim tab control
7. Cowl flap control
8. Compass correction card
9. Fuel/air mixture control lever
10. Throttle friction adjustment knob
11. Throttle control lever
12. Propeller control lever
13. Supercharger control lever
14. Cockpit/instrument lights
15. Mk VIII reflector gunsight, with backup ring-and-bead sight
16. Eight-day clock
17. Artificial horizon
18. Airspeed indicator
19. Turn-and-bank indicator
20. Tachometer
21. Altimeter
22. Rate-of-climb indicator
23. Carburetor air temperature gauge
24. Cylinder head temperature gauge
25. Oxygen flow blinker
26. Oxygen pressure gauge
27. Ignition/magneto selector switch
28. Master battery switch
29. Turbo tachometer
30. Compass
31. Combined fuel/oil pressure and oil temperature gauge
32. Fuel quantity gauge
33. Manifold pressure gauge
34. Hydraulic pressure gauge
35. Engine primer
36. Oxygen hose
37. Oxygen demand regulator
38. Water pressure gauge
39. Instrument vacuum gauge
40. Starter switch
41. Directional gyro
42. IFF/recognition light control switches
43. Radio receiver volume control
44. Radio channel selector box
45. Secret radio detonator
46. BC-1206 radio range receiver
47. Cockpit vent control
48. Rudder pedals
49. Control column
50. Pilot's seat
51. Map case
52. Main switch box
53. Gun and camera switch
54. Landing flap control
55. Parking brake handle
56. Bomb/wing tank jettison levers (pylons, right; belly, left)
57. Main circuit breakers
58. Main fuel tank selector valve
59. Intercooler and oil cooler shutter switches

were vectored to attack a pontoon bridge over the Saar river. It was quickly rendered unusable for several hours.

The P-47s of the 513th FS were armed for mission flexibility, with the "frags" and rockets proving ideal for tackling flak positions. Around the town of Echternach, in eastern Luxembourg, pilots encountered a light/heavy mix of 13 flak guns. Six rockets and seven M81 "frags" made quick work of the "baker's dozen," with no damage being incurred by the Thunderbolts in return.

The 406th FG flew 12 missions on the 23rd, and things only got more intense on Christmas Eve. At 0900 hrs, Maj George Ruddell, leading the 514th FS, checked in with "Ripsaw" and his flight was vectored toward Houffalize, in Belgium, where it bombed and strafed several gun positions. Sweeping further east toward the Belgian town of Rettigny, he called out to Lt Arthur Sheldon that he was being fired on by flak:

> Lt Sheldon was pulling up off a strafing attack near Houffalize and I observed a battery of four 40mm guns firing at him. I called them out and he said, "I see them – I'll get them!" and rolled into a dive. At the same time, I observed another four-gun battery firing at our ships and I dove on them while Lt Sheldon's flight was working on the others. When I pulled up again, I saw aircraft wreckage burning on the ground near still another battery of guns. Calling on the R/T, I found that Lt Sheldon was missing. He was in a dive and too low to bail out when I last saw him. He had attacked a different battery than the one I called out to him.

The flak battalion spotted by the 514th had set up a perfect flak trap. While focused on one battery of guns, Sheldon never saw the remaining two batteries firing at him.

The FlaK 38's crew consisted of five men – a gunner (seated), commander, standing behind him with the binoculars, two loaders (behind and at right) and a range finder, calculating the distance to target with an EM.R.36 1-meter focal length type rangefinder. This particular battery formed part of the protection for a freight train. (Andy Saunders Collection)

ENGAGING THE ENEMY

3.7cm tracer rounds from carriage-mounted FlaK 43 batteries whiz past P-47D-27-RE 42-27221 as Col Leo Moon, CO of the 404th FG, climbs away after bombing a German train bringing supplies and reinforcements to the Ardennes front in late December 1944. While weather hampered low-level operations over the Ardennes for the first few days after the start of the German offensive on December 16, by the 23rd the clouds had cleared and the Ninth Air Force's fighter-bombers began working from before sunup to well after sundown, striking any motor or rail transport headed toward the frontline.

Rolling stock was among the highest priority targets for Ninth Air Force Thunderbolts, for destroying a train meant that hundreds of tons of much needed food, fuel and ammunition would not reach German soldiers at the front. Arming trains with flak emplacements was a partial solution, with both 2cm and 3.7cm guns becoming a standard fit aboard German trains. They were usually among the first targets selected by attacking Thunderbolts after they had destroyed the locomotive. The remaining rail cars would then be strafed.

Maj Ruddell's squadron continued to bomb and strafe the gun positions until all 12 flak guns, more than likely FlaK 43 3.7cm weapons, had been silenced.

The Ninth Air Force Thunderbolts kept up the pressure, flying constant missions during daylight and even into the night to support embattled American units on the

ground. The "Bulge" held, and as it was reduced through January; some of the most intense fighting of the war took place as the Wehrmacht was pushed back to within its own borders.

By the beginning of February 1945, IX TAC's Thunderbolt groups were operating from French and Belgian airfields that were well within striking distance of most targets in Germany. New pilots, aircraft and weapons were in steady supply to frontline units, and with the "Battle of the Bulge" now over, the mission focus shifted back to armed reconnaissance. Hunting trains and attacking enemy airfields became the priority, and both types of target were usually very well protected. As a result, the number of Thunderbolts being lost to flak, which had dipped significantly from October through to January, had begun climbing again by early March.

Trains were never safe from roaming Thunderbolts on armed reconnaissance missions. However, German tactics quickly made strafing them a more challenging and dangerous affair. In order to protect rolling stock and get much needed supplies to the front, the Wehrmacht began mounting flak guns aboard wagons for point defense. Usually 2cm weapons, but occasionally larger guns, the mobile flak protection did catch Thunderbolt pilots off guard. On March 12, 1945, for example, 404th FG CO Col Leo Moon got a rude awakening when he attempted to rocket and strafe two trains:

> I first saw a train with a number of cars on it and fired my four rockets into it, damaging the locomotive and setting two tank cars on fire. Then I saw a plume of smoke some distance away and fired my guns at the base of it. As I got nearer, I saw that the smoke was coming out of a short tunnel, and a train was protruding from the other end. As I swung around to make an attack on it, I saw a little red ball flash past my wing, and I wondered what it was. I soon found out.
>
> I saw some smoke coming up from the middle of the train, and thought that was a funny place for a train to be smoking. I suddenly realized it was gun-smoke from a flak car, banging away at me. I had already committed myself, however, and I banked around and sprayed the cars, and pulled up into the overcast. The flak sounded like hail on a tin roof as it hit my plane. My brake was shot out, and there was just a hole in my wing where my pitot tube had been.

Moon was lucky, and his Thunderbolt only took a few 2cm hits in the left wing. A more experienced gun crew, without a P-47 bearing down on them, would more than likely have adjusted their fire and brought his aircraft down. 404th FG groundcrews repaired his damaged machine, and it was back in the air within a few days.

In April, with the Third Reich collapsing rapidly, the Eighth, Ninth and Twelfth Air Forces began an all-out assault on the remaining Luftwaffe airfields in both Germany and Italy. On April 14, the 36th FG was in action over a number of airfields, intent on destroying as many Luftwaffe aircraft as possible so they could not be

Strafing trains was a dangerous business, as 404th FG CO Col Leo Moon discovered for himself on March 12, 1945. His Thunderbolt took several direct hits to its left wingtip from 2cm rounds, nearly severing the aircraft's pitot tube (seen here in the right hand of the groundcrewman) and damaging the bomb pylon. (USAAF)

used to attack US forces on the ground. Attacking such a target was akin to kicking a hornet's nest. Once alerted to the presence of enemy aircraft, flak gunners in fixed positions were ready and had plans and procedures in place to cover every possible avenue of approach toward the airfield.

By April 1945, the Luftwaffe had been pushed out of many of its airfields in western Germany, and sites quickly fell under "new management." The 36th FG, for example, had moved into Niedermendig (Y-62) on April 8 and immediately commenced flying combat missions. On the 12th, the group's new CO, Lt Col Paul P. Douglas, led 11 Thunderbolts in an attack on Kothen airfield from 0840 hrs, strafing everything in sight. Douglas led the destruction, claiming four He 111 bombers, two Ju 88 nightfighters, two "Me 210" (Me 410) heavy fighters, two Fw 190 fighters and two unidentified training aircraft destroyed, despite suffering significant flak damage to his own fighter-bomber. The rest of his flight was equally successful, contributing to the destruction of 73 aircraft on the airfield without loss.

The following day, the 36th continued its airfield rampage, hitting Wittenberg in the afternoon. The group launched a much larger force for this raid, with 35 Thunderbolts taking part. Wittenberg's flak gunners were more active, putting up an intense barrage as the P-47s began their attack. 1Lt Marvin Heiden's aircraft was hit on his first pass, his wingman, 2Lt Harold Goldstein, attempting to protect his element leader as they crossed the field:

> I was following about half the length of the field behind Lt Heiden. I observed smoke coming from his ship as he passed over the far boundary of the field. I informed him of the fact, and he asked if there were any flames. I told him that I saw none. We started flying about 245 degrees toward the bomb line. When approximately six or seven miles from the field, his engine quit, and I saw him open his canopy and bail out. Making a turn at the time, I lost sight of Lt Heiden and could not observe whether or not his parachute opened. He bailed out between 800 and 1,000 ft.

It is more than likely 1Lt Heiden's parachute failed to open in time, for he did not survive bailing out of his aircraft.

Back over the airfield, 2Lt Nic Arie, flying as "Red Two," found himself in similar trouble when the Ju 88 he had just set on fire exploded as he overflew it. The flak gunners converged on him at that point too."Red tracers and flying debris were all around him," recalled "Red Four," 2Lt John Hocking. "After he had passed through the explosion, I noted that he was leaking gas and smoking. Red Leader also told Red Three to go with him. When I saw that Red Three was with him, I returned to the enemy field to continue strafing. A few seconds later, I heard Red Three call Red Leader and tell him that Red Two had exploded in the air." 2Lt Nic Arie did not get out of his P-47.

The 36th's raid on Wittenberg was typical of late war fighter-bomber attacks on German airfields, where flak concentrations and significant ammunition supplies thanks to short logistics chains made attacking such targets considerably more dangerous than had previously been the case. Thunderbolt losses, which had risen in February, spiked again in March as the war in Europe drew to a close. Denying the Luftwaffe any ability to attack Allied formations by air was one of the top Ninth Air Force priorities, but this came at a high price in pilots and aircraft.

STATISTICS AND ANALYSIS

While Germany's heavy flak forces protecting its cities had some significant successes in deterring USAAF and RAF bombing raids, their tactical counterparts on the battlefield cannot claim to have had such an impact on Allied fighter-bomber operations that they caused even the slightest pause in operations. Unlike their heavy flak brethren, flak gunners on the battlefield often fought an intense "up close and personal" war against the *Jabos*, suffering high casualty rates as a result. During its withdrawal from Normandy, for example, III. *Flakkorps* lost nearly 1,000 guns and had 11,000 men killed, wounded or captured. Two of its three *Flaksturm* regiments were almost completely destroyed. During the escape from Falaise, partially because of a severe shortage of ammunition and partially due to the near panic that ensued as Army Group B was encircled, German flak in Normandy was rendered almost completely ineffective.

P-47 losses in the ETO peaked, unsurprisingly, in June 1944 when 189 aircraft were lost in combat. As the year continued, the numbers slowly fell, until it spiked again with the Ardennes offensive in December. That month, the Eighth and Ninth Air Forces lost 151 Thunderbolts between them to all causes. With the new year, P-47 losses dropped sharply, with January being the first month to see under 100 Thunderbolts destroyed since June 1944. The drop was partially due to poor weather for a good part of January and February, combined with a weakening in the opposition.

However, as Thunderbolt groups began flying from airfields within western Germany in March and April, the fanatical opposition increased. No fewer than 112

This Luftwaffe Sd.Kfz. 7/2 was knocked out by Twelfth Air Force Thunderbolts in Italy during late 1944. Destroyed and abandoned mechanized flak batteries littered the battlefields of Western Europe as well. III. *Flakkorps*, for example, lost nearly 1,000 guns during its fighting withdrawal from Normandy. (USAAF)

P-47s were lost in March and 88 in April. Just two were lost in the final eight of days of fighting prior to the cessation of hostilities on May 8. In all, more than 1,300 Thunderbolts were destroyed in combat, and it is believed that at least 40 per cent of these aircraft fell to German flak.

By March 28, 1945, there were 1,974 mission-capable P-47s in the ETO, with one group in the Eighth Air Force and 17 groups in the Ninth Air Force and 1st TACAF (Provisional). The Twelfth Air Force in the Mediterranean had 361 Thunderbolts on strength divided among the three fighter groups of XXII TAC, for a combined total of 2,335 USAAF P-47s on the European continent. The four Army Air Forces flying them had just lost 127 Thunderbolts between March 1–28, and yet operations bringing about the end of the *Flakwaffe* and, ultimately, the Third Reich were not visibly affected in the least.

Metrics for the P-47 Thunderbolt's employment against Germany, and specifically against the *Flakwaffe*, can be measured in thousands of missions accomplished and rockets fired, tens of thousands of sorties flown and bombs dropped, hundreds of thousands of gallons of napalm dropped and millions of rounds of 0.50-cal. ammunition fired and gallons of fuel consumed. At its worst, Thunderbolt losses amounted to seven per cent of the total force engaged for the month, and those losses in aircraft and pilots were replaced almost immediately by the USAAF's steady pipeline of men and materiel flowing from the USA to Europe.

In direct comparison, the *Flakwaffe* never overcame shortages in ammunition, spare parts and trained crews. In order to appease Hitler, German industry focused on producing complete guns, rather than the means to repair damaged ones. While overall flak production peaked in 1943, when more than 25,000 guns were built, the majority were heavy weapons to counter the bomber offensive. In 1944, there was a massive shift in emphasis that saw light and medium caliber flak weapons being built instead of heavy guns. While only 23,500 flak guns were built during the course of that year, production of light and medium caliber weapons more than doubled. In fact, it did not peak until November, despite German industry being hammered "round the clock" by Allied strategic bombers. Production continued at a high but lesser level until war's end.

Although light flak ammunition consumption for the Luftwaffe alone was roughly 12.5 million rounds per month by the fall of 1944, Allied fighter-bombers still freely roamed the skies of western Europe with relative impunity in search of targets. By the final quarter of 1944, 20 per cent of the Wehrmacht's budget was devoted to flak ammunition. However, the majority of that sum was dedicated to the production of shells for heavy flak batteries protecting German cities and industrial centers.

In addition to high rates of ammunition consumption, flak gunners also had to contend with ammunition blighted by an exceedingly high dud rate due to sabotage. By 1944, a significant proportion of all light flak ammunition was coming from factories employing slave labor. While quality control measures were in place, and the discovery of sabotage usually led to summary execution for the perpetrators, laborers continued to resist through any means possible.

German industry was unable to produce the required amount of ammunition to keep its frontline flak units adequately supplied. Moreover, it was unable to deliver that ammunition to the front in its entirety. Transportation of ammunition from the factory to the front required trains, which were among the highest priority targets of Thunderbolts on armed reconnaissance missions. Significant quantities of ammunition failed to make it to intended units as a result.

By the summer of 1944, Hitler wanted to do away with the *Jagdwaffe* almost entirely and focus on flak production instead. While it was virtually impossible to eradicate the fighter arm, production did shift in favor of the *Flakwaffe* as the year went on. But flak, both light and heavy, only delayed the inevitable defeat. Over German cities, flak was an ever present threat to the bombers, but one that could be mitigated. At low altitude, the *Jagdwaffe* was more effective in countering the fighter-bombers than flak was, as a flight of Thunderbolts would be forced to drop their ordnance in order to confront an attacking formation of German fighters. However, with the Luftwaffe unable to afford the loss of trained pilots, and lacking fuel (virtually all of the Luftwaffe's meager fuel reserves was allocated to the defense of the Reich and countering the USAAF's strategic bombers), it rarely challenged Thunderbolt formations in the final months of the war.

Analysis of the *Flakwaffe*'s performance against the Allied air forces at the strategic level has been almost continuous since the end of World War II. Examination of the tactical flak arm and its effectiveness against Allied fighter-bombers, however, has been largely overlooked. Flak was the most significant threat to Thunderbolt pilots from February 1944 through to May 1945, but it failed to turn back a single fighter-bomber mission. The Thunderbolt could absorb damage to a certain extent, and a few 2cm hits were usually survivable unless something vital was hit. Encounters with 3.7cm guns were rarer, but more devastating when the gunners found their mark. A better 2cm weapon could have had a more significant effect on flak operations had it been fielded in early 1944, and the introduction of a greater number of 3.7cm weapons may have been more devastating against aircraft flying at low altitude.

The fact that Thunderbolts were able to operate at all altitudes with relative impunity and were never turned back from a target clearly illustrates who was the victor in this duel.

2Lt Alva D. Henehan poses for the camera within the large-caliber flak hole punched through the trailing edge of the wing of his P-47D on December 21, 1944. He was assigned to the 346th FS/ 350th FG at the time. (NARA)

AFTERMATH

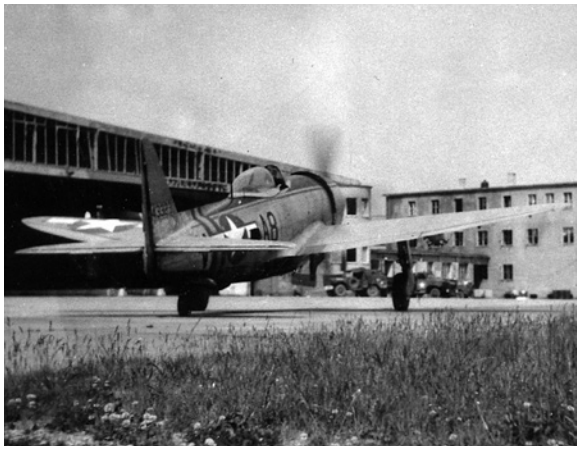
"It is clearly obvious that under such circumstances, German tactical movements during daylight were impossible, or could only be carried out at a considerable cost in casualties, materiel losses and loss of time, and with the knowledge of the enemy."
General der Flakwaffe Wolfgang Pickert

While much attention has been given to the strategic bombing campaign in World War II, analyzing both its successes and failures, there has been comparatively little research done on the impact the tactical campaign had on the outcome of the war. The strategic campaign kept more than a million military personnel within Germany's borders, manning the heavy antiaircraft guns that engaged the high-flying Allied bombers. But it was the tactical campaign, led by the Thunderbolts of the Ninth and Twelfth Air Forces, that hastened the end of the conflict. Not only did the P-47 help break the back of the *Jagdwaffe* when used as a high-altitude bomber escort, but at low level, the Thunderbolt fighter-bomber destroyed a significant portion of the means required to get war materiel to the front. Finally, it also destroyed much of what actually reached the front.

Daytime movement of vehicles and materiel was a dangerous business with Thunderbolts overhead, as evidenced by these destroyed FlaK 36 8.8cm guns and their prime mover in western Germany. (NARA)

German vehicle and rail traffic was paralyzed during daytime hours because of the ever-present Thunderbolts. The Wehrmacht could not advance, retreat or resupply its troops in the field because of the relentless air attacks. There was even an adage among German soldiers that "if the airplane was silver, it was American, if it was camouflaged, it was British, and if it wasn't there, it was German."

And yet despite the Thunderbolt's successes, flak was always a constant threat throughout the entire war over Europe. P-47 losses to flak were three times higher than its losses to enemy fighters. Of those damaged Thunderbolts that managed to return to base, flak holes kept them on the ground and out of the fight until they could be repaired, thereby reducing mission readiness and the ability to prosecute the war. Short- and medium-range flak was by far the biggest threat to Thunderbolt pilots – a threat that never truly diminished from the moment P-47s first dropped down to low altitude through to VE Day.



P-47s continued to serve after the war, with several deactivating groups consolidating their aircraft into units like the 27th, 86th, and 366th FGs as their pilots and groundcrews rotated home. Within months of the war ending, the distinctive red/yellow/red tail bands of the occupation were added to Ninth Air Force Thunderbolts for quick visual identification. This particular P-47D-30-RA was assigned to the 366th FG. (NARA)

Yet while the threat to Ninth and Twelfth Air Force Thunderbolts never lessened, the *Flakwaffe* was never able to prevent P-47 pilots from reaching their targets and completing their missions. If one Thunderbolt were shot down on a strafing mission, at least three others would still accomplish their objective. Republic was able to maintain a production tempo that could replace lost aircraft in the ETO far faster than the USAAF was losing them. American pilots also had the luxury of being thoroughly trained in the US prior to heading overseas, and then rotating home after they had completed a set number of missions or combat hours. Those combat veterans then often became instructors, teaching the next classes of would-be Thunderbolt pilots how to survive by telling them what to look for from the enemy when undertaking a combat mission.

Better weapon systems like air-to-ground rockets gave Thunderbolt pilots increased standoff range against flak guns, and the development of new techniques suppressed enemy guns with a fair degree of success while other P-47s accomplished their primary mission. The *Flakwaffe* attempted to stay abreast with new technology by creating new and innovative weapons systems, but it was never able to field sufficiently trained crews to man them. Flak crews were kept in combat until they were either killed, wounded or captured. Newly arrived replacement crewmen were at a distinct disadvantage, having received only abbreviated basic training, and more than likely no training on the weapon system they would end up operating in combat as part of a team. As a result, by war's end, newer systems like the FlaK 103/38, FlaK MG151/20 and Hs 297 Fohn Flakrakete all required smaller crews to operate them.

The Thunderbolt had a decisive technological edge over the *Flakwaffe* that would be impossible to overcome. P-47 pilots, in direct communication with ground controllers and even units on the ground, were easily guided to where the enemy was. This meant that they were able to hunt German vehicles, trains and even flak guns with near impunity in the closing months of the war. Even when flak gunners were successful, the USAAF could sustain the losses and replace both aircraft and pilot almost immediately without a significant drop in combat effectiveness. The Germans simply could not sustain losses in men and equipment and remain viable on the battlefield. By the end of April 1945, all of the Ninth Air Force's Thunderbolt groups, and two of the three XII TAC P-47 groups, had occupied and were flying from bases within the borders of the Third Reich. Unable to sustain the war any further, Germany surrendered on May 8, 1945.

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P-47D cover art

On March 12, 1945, the 404th FG engaged an armored formation that was discovered massing northeast of Bonn, in Germany. The Wehrmacht had moved into this sector of the frontline in order to oppose the US Army's 78th Infantry Division, which had been forced to halt its advance upon reaching the Sieg river. The 404th's 508th FS, led by Lt Luciano Herrera, was the first on the scene, and by the time the squadron had expended its ammunition, 15 armored vehicles were burning. The 506th FS rolled in next, inflicting similar damage on the now completely disorganized German unit. By the time Lt Col Howard Galbreath's formation from the 507th FS arrived overhead, significant damage had been inflicted on the target. There were, however, a number of armored vehicles that had been left unscathed, so Galbreath, flying his personal P-47D-27-RE 42-27365 *BOBBY SNOOKS*, led the attack with 500lb GP bombs, Mk 7 rockets and 0.50-cal. machine gun fire. The 507th duly claimed six armored vehicles destroyed. Although the light flak was accurate and intense over the target, no Thunderbolts were lost. (Artwork by Gareth Hector)

Sd.Kfz. 7/1 cover art

Once the Allied armies had broken out from the Normandy bocage in late July 1944, the situation on the ground for the Wehrmacht quickly became dire. By August, 7th Army was in serious danger of being encircled and destroyed. The Luftwaffe's III. *Flakkorps* had been defending 7th Army since the beginning of the Normandy campaign, and, using mechanized weaponry like this Sd.Kfz. 7/1, had inflicted significant losses against Allied fighter-bombers in the two months since the invasion. The *Flakkorps'* four *Flaksturm* regiments were called upon to cover 7th Army's escape through the Falaise Pocket, protecting it from both aerial and ground attack, while the Wehrmacht retreated. The Sd.Kfz. 7/1s of *Leichte Flakabteilung* 80 (*selbstfahrend*) were in the thick of the action as part of *Flaksturmregiment* 2, desperately fighting to keep the Pocket open to facilitate 7th Army's escape. The quartet of *Flaksturm* regiments were among the last to escape Falaise, and they suffered roughly 50 per cent casualties in men and equipment. Despite their losses, the *Flaksturm* regiments remained combat effective throughout the Falaise debacle, and were able to retreat, refit and retrain to again oppose the advancing Allied armies. (Artwork by Gareth Hector)

Title Page

On Maj Loren Herway's 123rd combat mission (over the Ardennes in December 1944), his Thunderbolt took a direct 3.7cm flak hit that shredded the rear of his fighter. The 23-year-old CO of the 362nd FG's 377th FS was able to nurse his crippled Thunderbolt back to Verdun (A-82) airfield, where he "bellied" it in. The P-47 was written off. (NARA)